# BULLETINS

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*June 30, 1919*

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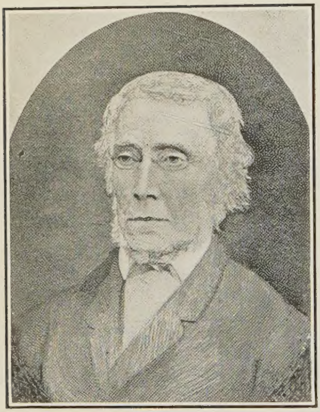
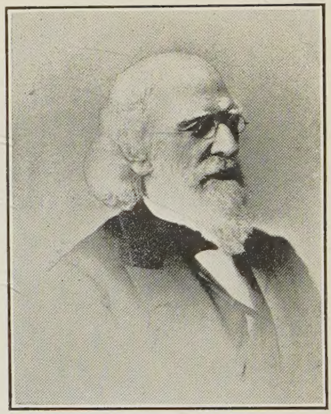
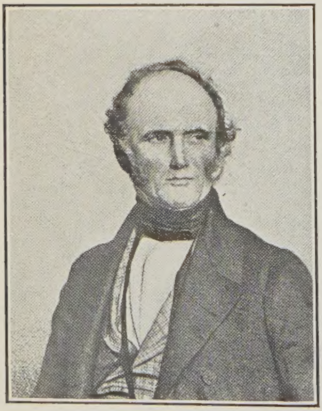


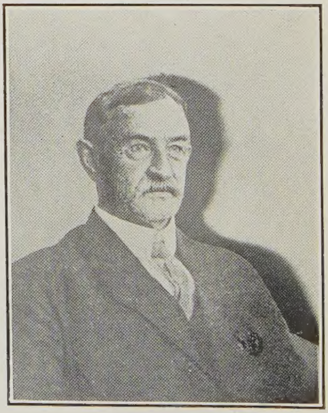
*Timothy Abbott Conrad*
*1803 - 1877*



*Isaac Lea*
*1792 - 1886*



*Sir Charles Lyell*
*1797 - 1875*



*Truman Hemingway Aldrich*
*1848 - ———*

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# PELECYPODA OF THE ST. MAURICE AND CLAIBORNE STAGES

BY

G. D. HARRIS

*June 30, 1919*

Cornell Univ., Ithaca, N. Y.
U. S. A.
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To The

HON. TRUMAN H. ALDRICH

Who has continuously maintained that true Conradian love for
Our Eocene. Mollusca from the last days of that forgetful dreamer
On into the Twentieth Century this work is
Most respectfully dedicated

By the Author

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# ACKNOWLEDGMENT

In '92, during one of those pseudo- economic, or political paroxysms that formerly afflicted our federal Geological Survey, the writer, an employé of that organization, very naturally found it necessary to seek other quarters where his work in Tertiary Paleontology could be advantageously continued. Through a recommendation of Chief Paleontologist Walcott (now Secretary of the Smithsonian Institution) such a haven was found on the State Geological Survey of Texas, then being ably administered by Mr. E. T. Dumble.

Field parties had for several years been bringing into the Museum at Austin Tertiary material. A very little of this had been reviewed by Heilprin of Philadelphia, but the great mass was practically untouched.

Two seasons' work with visits to Washington and Philadelphia to consult type material, and a trip through Alabama and Mississippi for additional specimens resulted in getting together a fairly complete monograph on the Texas Eocene Mollusca, a MS of some 350 pages and 31 plates. The illustration was excellently done by the late McConnell and the plates were actually engraved. However, till this day the report has remained unpublished. But the large share of the new species were long since brought out in the Philadelphia Academy's Proceedings, and the lists of fossils from various localities have been very largely quoted. Occasionally in the present report the writer has made use of the proof plates from his old Texas Report. But in general, it has seemed best to use photographs of material now deposited in the University collection, for, aside from their lack, perhaps, in sheer artistic beauty, they do express the finer specific idiosyncrasies oftentimes far better than do the best of drawings.

While conducting a Geological Survey of Louisiana for ten consecutive years considerable additional trans-Mississippian Eocene material was collected, especially during the early years of reconnaisasance when young Veatch's (A. C.) delight in difficult and successful exploits brought in splendid material from hitherto unheard of localities.

While visiting Washington with pockets and bags full of material for comparison, the writer has been received by the Department of Mollusca as a prodigal son, in the spirit of true friendship. It is certainly fortunate for American Tertiary Paleontology that there has been at the National Museum a man of Dr. Dall's erudition and sympathetic interests.

It is much to be regretted that time and means have not been at the writer's command for properly illustrating more of Conrad's type specimens at the Philadelphia Academy. Yet with the bivalves the need is not so great as with the univalves. The facilities for work already afforded at the Academy by the curator, Dr. Pilsbry could not be better and in the near future the writer hopes to have the greater, or, as yet poorly illustrated, part, of the Conradian collection properly photographed.

Aside from the facilities the writer has enjoyed in working out his own material at various museums, mention must be made of the fact that among others, Dr. Dall of Washington, Hon. T. H. Aldrich of Birmingham, Alabama, and Prof. Whitney of Austin, Tex., have sent specimens for comparison and have loaned co-types and furnished materials used in various genera throughout this work as will be noted in reading descriptions and consulting the illustrations with their accompanying explanations.

# PELECYPODA OF THE ST. MAURICE AND CLAIBORNE STAGES

BY

G. D. HARRIS

In a general way the Eocene series of the Gulf border may very properly be subdivided into five stages,—three representing for the most part marine sedimentation ; two palustrine though locally becoming marine and filled with beautifully preserved mollusca. In their natural sequence these stages are :

Jackson stage, marine
Claiborne stage, lignitic or lacustrine
St. Maurice stage, Marine
Sabine stage,* lignitic or lacustrine
Midway stage, marine

In the summer of 1895 the writer made a somewhat extended expedition in the Southern States east of the Mississippi, visiting and collecting from such localities as might furnish well preserved basal Eocene fossils. The results of this expedition were combined with observations previously made while on the Arkansas and Texas Geological Surveys, and published as Bulletin No. 4 (Amer. Pal.) June, 1896. After another extensive field season in a slightly more southern latitude along the outcropping of the next higher stage, Bulletin No. 9 appeared (June '97) on the Pelecypoda of the Lignitic Stage ; the Gastropoda, Pteropoda and Cephalopoda followed in May '99 as Bulletin 11.

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*Now known as the *Sabine stage* from the river by that name separating Sabine County, Texas and Sabine Parish, La. and showing good fossil-

Many things have delayed the appearance of our work on the higher Eocene stages. First among these has been an almost constant connection with National, State or private surveys demanding a vast amount of time on subjects generally but distantly related to Tertiary paleontology, yet admitting of occasional studies of out-of-the-way places in middle Eocene areas, hence increasing our collections and adding slowly to our knowledge of these interesting stages. Five times in our goings and comings to the Gulf region have we touched at the very center of mid-Eocene interest, Claiborne Bluff, collecting always new fossils and facts for future study and illustration. But from the very nature of human affairs there must come a time when field work is temporarily suspended and notes and fossils are given undivided attention if this work, now so long delayed, is ever to appear.

It would doubtless be more in accordance with precedent and perhaps more logical to treat here of the mollusca of the St. Maurice stage only, the so-called Lower Claiborne of our various previous contributions. For, the more we study the so-called Claiborne and Lower Claiborne faunas the more distinct do they appear. The Lower Claiborne or St. Maurice represents an age of general depression along the Gulf border with widely distributed molluscan remains; the Claiborne, a somewhat uplifted lacustrine condition with rarely local depressions sufficient to allow of the incursion of the warm seas from the south with their teeming marine life. One notable example of this kind is to be seen at the famous Claiborne bluff on the Alabama, though in the roadside

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iferous outcrops along its banks. Exception has been taken to the name Sabine since Penrose made use of the expression "Sabine River beds" to include certain horizons not included within the stage as now defined. This use of a descriptive expression can scarcely invalidate the clearly defined name as proposed by Veatch and sanctioned by the proper authorities of the U. S. Geological Survey. The name Wilcox, since used by that bureau lacks priority and is based on an obscure county name in Alabama, one that in no way carries the historical significance of Sabine, nor would it be found on general maps of the United States.

scarcely a mile above, the "sands" give way largely to lignitic deposits. However, the complete differentiation of these two stages has not been satisfactorily carried out in western Texas and in the Carolinas. Nor even in Georgia do we know to a certainty the distribution of each of these stages. Again, there is an advantage, physical at least, in having species of adjacent stages figured together on the same plate.

References to the literature together with discussions of local and general stratigraphy will follow in due season. Extensive synonymies and discussions of provenance and relationship of species are withheld for publication in PALEONTOGRAPHICA AMERICANA. We are interested here solely in illustrating and describing the mid-Eocene molluscan fauna of our southeastern coast. Some species run through several Eocene stages and may have already been referred to and figured in previous Bulletins on the Midway or Sabine stages. The mid-Eocene facies of such species will be herewith figured, but the original description must be found by referring to former Bulletins.

G. D. Harris.

Cornell University,
Feb. 17, 1919.

# PELECYPODA

**Ostrea alabamiensis** Lea, Plates 1-5.

*O. gigantissima* Finch (in part), undescribed, A. J. S., vcl. 7, 1824, p. 39.

*O. alabamiensis* Lea, Cont. to Geol., p. 91, pl. 3, fig. 71, 1833.

*O. semilunata* Lea, *ibid*, p. 90, pl. 3, fig. 69.

*O. lingula-canis* Lea, *ibid*, p. 92, pl. 3, fig. 72.

*O. pincerna* Lea, *ibid*, p. 92, pl. 3, fig. 73.

*O. georgiana* Co., Jr. Acad. Nat. Sci., Phila., 1834, vol. 7, p. 156.

*O. contracta* Con., Proc. Acad. Nat. Sci. Phil., 1855, p. 269; also Mexican Boundary Surv., pl. 18, fig. 1.

*O. alabamiensis* and *georgiana* Con., Am. Jr. Conch., vol. 1, 1865, p. 14-15.

*O. alabamensis* de Gregorio, Mon. Faun. Eoc., 1890, p. 175, pl. 18.

*O. alabamiensis* Cossm., Ann. de Géol., 1893, p. 18.

*O. claibornensis* Con. MS, Harris, Bull. Am. Pal., vol. 1, p. 3, 1895.

*Ostrea alabamiensis* Har., *ibid.*, p. 3.

*O. alabamensis* and *georgiana* (in part) Dall, Tr. Wag. Free Inst. Sci., vol. 3, p. 678-683, 1895.

? *Ostrea vomer* Clark & Martin, Geol. Surv. Md. Eoc., p. 193, pl. 1, 1910.

*Lea's original description.*—Shell subelliptical, curved behind, crenulate on both sides of the beak; beaks recurved, pointed.

Diam. . . . Length 2.1, Breadth 1.5 of an inch.

A single valve only of this species has been received by me. The exterior of this is roughly squamose.

The most remarkable character of this species is the fine divaricate sculpturing of the corneous epidermis. *O. prismatica* Gray, as described by Reeve from Panama (Conch. Icon. pl. 1. fig. 1) possesses this feature to some extent. Of the four forms figured and described by Lea, *O. alabamiensis* represents most clearly the normal form, hence the name has been retained in preference to the others, although one was described on a previous page. Lea's figure of *alabamiensis* is, however, a little misleading in that it appears to represent a fairly thick shell. The specimen from which the figure was drawn is thin and pearlaceous. *O. semilunata* evidently grew in close proximity to a root, stick, stone or other object and became somewhat distorted. Its peculiar shape as figured caused Conrad to refer it to his *O. sellæformis* (Am. Jr. Conch., vol. 1, p. 15, 1865), a mistake he certainly would not have made had he ever seen Lea's shell. Occasionally at Claiborne and especailly at Gosport this species shows specimens of six or more inches in length (pl. 1). Some, of this character, in the Philadelphia Acad. Coll., are labelled in Conrad's handwriting *Ostrea claibornensis.*

We strongly suspect that the surrounding conditions at Claiborne during the deposition of the "sands" were not favorable for Oyster development. Shells grown to considerable size are often thin, very gibbous and *Anomia*-like (pl. 2, fig. 1 and pl. 6, fig. 1). These specimens show the exterior radiating lines already referred to at great advantage. If the oyster lives beyond this stage, it seems diseased and is usually very much deformed in some way or other (pl. 2, fig. 3). Parts may be very thin or thick ; exteriorly smooth or highly foliated (var. *frionis* pl. 5, fig. 1 ; marginal crenulations may be present or absent ; a great lengthening of the shell is of common occurrence, causing a contracted appearance toward the beak. Hence the derivation of the variety *contracta* (Proc. Ac. Nat. Sci. Phila., 1855, p. 269 ; and Mex. B'dy. Surv., p. 160, pl. 19, figs. 1, a b c d, 1857) of the Rio Grande section. Not all the specimens along the river are "contracted." The more southerly, Jackson exposures as a rule furnish the typical *contracta* while the northerly exposures, furnish more nearly typical *alabamiensis.* In this section of the country in late Eocene times, it appears that conditions were less hostile to this type than at Claiborne. Far to the east again, in eastern Georgia, South Carolina and North Carolina the *georgiana* flourished in great profusion. That this is the eastern equivalent of *contracta* or well-fed *alabamiensis*, we have no doubt. It often shows the peculiar, radiate marking of the exterior referred to above.

*Type.—Alabamiensis.* No. 5439 Phila. Acad. Of *contracta*, U. S. Nat. Mus.

*Horizon.*—St. Maurice, Claiborne and Jackson Eocene.

*Specimens figured.*—Mostly Mus. Cornell Univ. ; but pl. 4 and pl. 5, figs. 1 and 3 from Texas State Mus.

*Localities.*—Texas : Along the Rio Grande 2 mls above San José, just above the mouth of Good Cr., Zapata Co. ; at Webb-Zapata Co. line, 5, and 13 mls below Laredo ; Cedar Creek and Dunn ranch, Robertson Co. ; 5 mls W. of Crockett, W. of Caney Rayou, San Antonio road, Houston Co. ; 4 mls N. E. Alto, Cherokee ; S. E. Corner of Frio Co.

Large specimens described by Conrad as *O. contracta* were from "Oyster Point, near Mier, Tex." Other localities for the same are : Rio Grande at Carrizo, above Roma, 15 mls below Carrizo and at Campbellton, Atascosa Co. ; Oyster Bluff, Brazos River, Milam Co., 2 mls above the mouth of Pond Cr. South Fork of Hurricane Cr.

*Louisiana :* Sabine River, near Columbus as in nearby E. Tex. ; 3 mls S. E. of Negreet ; in form of cast 2 mls N. of Plaindealing.

*Alabama :* Claiborne, Gosport, Lisbon, Hamilton Bluff.

*Georgia :* Grovetown, Shell Bluff.

*South Carolina :* Rocky Swamp, Orangeburg Dist.

*North Carolina :* very abundant on the Neuse and Trent Rivers. See especially exposure near R. R. bridge at Pollocksville.

The localities mentioned above are those from which we have personally identified this form. Various authors, especially Dall, have mentioned this species (under the name of *georgiana*) as having a wide Oligocene distribution in Florida, as the "*leit fossil*" of the Grand Gulf (See Trans. Wag. Free Inst. Sci., vol. 3, p. 685, &c). We cannot speak with authority on the wide geologic range here suggested.

**Ostrea sellæformis,** Plates 6-8.

*O. sellæformis* Con. Foss. Sh. Tert. Form., p. 27, pl. 13, fig. 2, 1832.
*O. radians* Con. *ibid*, fig. 1.
*O. divaricata* Lea, Con. to Geol., 1833, p. 91, pl. 3, fig. 70, 1833.
*O. sellæformis* Con., Proc. Nat. Inst., 1842, p. 192, pl. 1, fig. 1.
*O. sellæformis* Heilp., Ann. Rept. (IV), U. S. Geol. Surv., 1883, p. 311, pl. 62, figs. 1, 2 ; pl. 63, fig. 1.
*O. sellæformis* de Greg., Mon. Faun. Eoc., p. 175, pl. 19, figs 1-12, 1890.
*O. sellæformis* Dall (in part), Tr. Wag, III, p. 677, 1898.
*O. sellæformis* Clark and Martin, Geol. Surv. Md. ; Eocene, p. 192, pls. 48, 49, 1901.

Conrad describes the one valve of this species as *radians:* Oblong, compressed, lobed and flexuous on one side; the ribs numerous, radiated; beaks very small, not prominent, pointed and a little curved laterally, Vance's Ferry, S. C.; Claiborne, Ala.

*O. sellæformis:* Oblong, convex, thick and ponderous, lobed; one side of the larger valve profoundly sinuous and the opposite side gibbous; smaller valve sinuous and a little convex; dorsal margin long and slightly arched, with both extremities obtusely rounded.

Since these are but different valves of the same species, Conrad's intimation that there are two valves of his *sellæformis* was based on an error. This error, however, he corrected in 1842, strangely choosing *sellæformis* instead of *radians*, a more appropriate name perhaps, and coming first in his original publication.

As species are most generally defined in modern literature several of the *sellæformis*-like forms here included under one name might be regarded as distinct species.

With a small amount of material at hand, from a limited number of localities, perhaps no one would hesitate to affirm that very well defined species could be differentiated. But with the increase of material from intermediate localities the seeming distinctness of certain types rapidly disappears. Nevertheless there is considerable fixity to some of these varietal forms and it is well worth while to have them defined and named and have their interrelations and stratigraphic significance pointed out.

**O. sellæformis var. smithvillensis,** Plate 8

From Smithville, Tex., are derived numerous small specimens with thin shells, and rarely, larger representatives, showing one plicate valve and one nearly smooth valve, giving a somewhat *compressirostra* appearance. Yet the plications are very numerous and without the foliations and squamose characters of the latter species. The flat valve shows signs of weak plications. There is an entire lack of a marginal kink or fold—the feature doubtless first suggesting the name *sellæformis.*

**O. sellæformis** (typical) Pls. 6 and 7.

Rarely in Texas do the large, ponderous, saddle-formed mutations of this species occur. From near Columbus on the Sabine, eastward through Wautubbee and Hickory, Miss., Claiborne, Coffeeville and Lisbon, Ala.; Shell Bluff, Ga.; Vance's Ferry, S. C.; City Point and Piping Tree, Va., these heavyweights are of common occurrence.

Young, comparatively thin specimens of this type have a wide distribution in the St. Maurice beds of Texas, and are not uncommon eastward to the Carolinas. In these the posterior kink is not always well defined and now and then there is a slight trace of radial sculpture on the flat valve. (See pl. 6.)

Var. *divaricata* Lea simply represents young individuals without a definite posterior kink and without a posterior cardinal alation. Such specimens are occasionally found with other varieties at Claiborne, Ala., Negreet, La., and elsewhere. (See pl. 9, fig. 7. Dall mentioned also Natchitoches Parish, La., Choctaw Bluff, Ala., and City Point, James River, Va.

Var. *vermilla* de Greg. Like *divaricata* but with posterior alation of cardinal area. Described from Claiborne; our best specimens from Bienville Par., La. (See pl. 9, fig. 8.)

*Type.*—Phila. Acad.; from the lower calcereous layers, Claiborne Bluff, Ala.

*Horizon.*—St. Maurice and Claiborne Eocene.

*Specimens figured.*—Pl. 6, figs. 2-12, young specimens from the base of the bluff at Claiborne; pl. 7, adult from the same locality; pl. 8, var. *smithvillensis*, C. U. Museum, from Smithville, Tex,; pl. 9, fig. 7, var. *divaricata*, C. U. Mus., from Newton, Miss.; pl. 9, fig, 8, var. *vermilla*, C. U. Mus., Beinville Parish, La.

**Ostrea sellæformis** (?) var. **lisbonensis,** Pl. 9. Figs 1-6

We have never felt satisfied with the general reference of this form to *sellæformis* and have long kept it apart from Conrad's species in our collections under the designation of *lisbonensis*. It occurs large and well defined at Lisbon, Ala., but it is in Louisiana where it is typically and extensively developed. When adult, it reaches about one-half the dimensions of the large *sellæformis* in the bluff at Claiborne. The coarse plications, aviculoid form, posterior emargination and convexity of both valves which, by the way, are of a thick, dense make-up, distinguish it from the thin, nearly flat, multicostate, less aviculoid, less emarginate and early kinked young and adolescent individuals of *sellæformis*.

Whitfield described in U. S. Geol. Surv. Mon. IX, p. 222, pl. 29, fig. 2, 1885, a cast of an oyster from the Shark River Eocene beds of New Jersey under the name of *O. glauconoides*, and referred specimens from the base of the bluff at Claiborne to this species. But, even with the New Jersey type in hand (kindly loaned by State Geologist Kümmel) it is impossible to state whether the New Jersey and Claibornian specimens should be referred to the species. The former evidently had a much thinner shell and was inflated near the beak.

*Type.*—Paleont. Mus. Cornell Univ.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Chestnut, La.; Harris Collection, now deposited at Cornell.

*Localities.*—Collier's Ferry, Burleson Co., likewise from Brazos, Robertson, Cherokee Co's., Tex.; Natchitoches, Marble Q'y, Chestnut, 35 mls S. E. of Creston, in Bienville Phrish, and at Chautauqua, La; Lisbon and Hamilton Bluff, Ala.

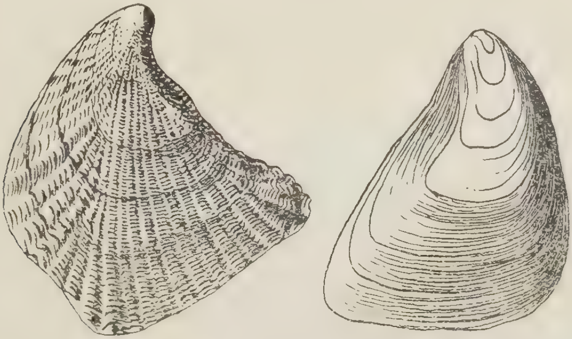

Fig 1. *Ostrea* var. *perplicata* Dall

Variety *perplicata* Dall

Dall in his Florida Fossils as published in the Transactions of the Wagner Free Institute of Science, vol. 3, p. 678, names a variety of *sellæformis*, *perplicata* from "Eocene, Caton's Bluff, Conecuh River, Alabama ; L. C. Johnson." This is an inalate form of the same stock as our *lisbonensis*. The description reads :

"Shell very heavy, arcuate triangular, with coarse, rounded, numerous divaricating ribs (twenty-five to forty), no auriculation or posterior sinuosity of the margin near the hinge, the upper valve extraordinarily ponderous, the general form regular and uniform, the valve margins nearly or quite simple.

The figures herewith shown are of "Co-types" kindly furnished by Dall, and are in the U. S. Nat. Mus. collection.

**Ostrea vicksburgensis**, var. **ludoviciana**. n. var. Pl. 10, figs. 1-10

In Conrad's description of *O. vicksburgensis* he gives no characteristics that would necessarily demand that this variety be referred to this species. The description (Proc. Acad. Nat. Sci. Phila., 1847, p. 296) reads as follows :

> Plicated ; very irregular and adhering, the upper valve not flat, but swelling in an irregular manner. Height 1¾ in.
>
> Their is nothing peculiar about this shell, yet it is clearly distinct from any other species of the American Tertiary hitherto described. Common.

This species is again described in the Journal of the Academy, (vol. 1, p. 126) and a figure is given (pl. XIII, fig. 5) but with this additional information the species would still be ill defined.

It has sometimes been referred to *O. panda* Mort. on account of fig. 10, pl. 19, of Morton's Synopsis. The name *panda*, however, applies only to the species from the vicinity of St. George's on the Delaware and Chesapeake canal, referred primarily by Morton (1830, A. J. S. vol. 17, p. 284) to *cristagalli* with a question, and figured as such in vol. 18, pl. 3, fig. 22. The name *panda* was proposed in 1833 (*id.* vol. 23, p. 293) for this Cretaceous species. In 1834, in the "Synopsis &c" Morton includes several Tertiary specimens under the name *panda* and figures one on pl. 19, fig. 10. Gabb, 1861, (Proc. Phila. Ac.) seeing this impropriety proposed the name *mortoni* for the Tertiary specimens. An examination of the specimens in the Phila. Academy

Gabb had before him in naming *mortoni*, is quite sufficient to prove their identity with *vicksburgensis*. One specimen, Morton's original of fig. 10 and used by Gabb as one of his *mortoni*, had a general resemblance to our form *ludoviciana*. The radiating ridges are rather sharp plications than rounded ribs so common in *ludoviciana*—somewhat like the ornamentation of the Miocene *subfalcata*. It passes insensibly into coarsely plicate *vicksburgensis* two or three inches in diameter.

*Varietal characterization.*—General form and size as figured ; left valve gibbous, extended at lower posterior margin ; ribs on post-umbonal slope faint, generally about six in number ; anteriorly, ribs strong, 6-12 often bifurcating, especially strong from beak to posterior margin. Lesser valves concave, decidedly of the appearance of the lesser valves of some small Exogyras.

*Type.*—Harris collection at Cornell Univ. No's. 2-6, Natchitoches, La. ; 1, 7-10, Chestnut, La.

*Geologic horizon.*—St. Maurice Eocene.

*Localities.*—Especially in Natchitoches Parish, La., about Natchitoches, Provencal, Robeline and Chestnut ; also Bienville Parish and Columbus, Sabine Parish. That it occurs as far east as Alabama several not exactly localized specimens from this State in the Museum attest. Long drawn out, claw-shaped mutations are common along the Sabine River, near Columbus.

**Ostrea johnsoni,** Pl. 10, figs. 11-15.

*O. johnsoni* Ald., Bull. 1, Ala. Geol. Surv., 1886, p. 41, pl. 6, fig. 6.

*Aldrich's original description.*—"Shell large, thick ; both valves convex ; beaks pointed in lower valve ; breadth of shell greater than length ; both valves strongly plicate, generally with six folds, the plications becoming very deep with age, the concave part between the two basal folds running out into a long curved tongue ; surface strongly laminated, laminæ terminating at edge of shell ; attachment scar not visible ; ligamental area with a rather deep, transversely striated furrow in the lower valve, shallower and broad in the upper ; muscular scar, large nearest the base and posterior margin ; curved, spatulate, nearly straight on upper side.

This form seems to be confined to the Lower Claibornian above the Buhrstone."

Dall remarks (Trans. Wag. III. p. 681): "This is an excellent species with a few strong plications, making the valves claw-like."

The number of plications varies greatly, see pl. 10.

This species seems to have a very limited range, from Cunecah River, Ala., to Newton, Miss.

*Type.*—Aldrich Coll. (Johns Hopkins Univ. Mus.)

*Horizon.*— St. Maurice.

*Specimen figured.*—Cornell Univ. Mus. (11-13, Caton's Bluff; 15, Lisbon, Ala.)

*Localities.*—Claiborne, Lisbon, Newton, (*fide* Ald.) also at Caton's Bluff, Conecuh River, Ala.

**Anomia ephippioides** /Pl. 11. Figs. 1-3.

*A. ephippioides* Gabb, Ja. Phila. Acad. Nat. Sci., 2d Ser., vol. 4, 1860, p. 388, pl. 67, fig. 59.

*A. ephippioides* Dall, Trans. Wag. &c., vol. 3, 1898. p. 782.

*Gabb's original description.*—"Very irregularly sub-quadrate, sometimes very nearly circular, sometimes almost triangular; convex, occasionally marked by longitudinal rugæ, and always by distinct lines of growth; lower valve, the muscular foramen large, ligament margin thickened.

Size of largest specimen: Length 1.5 in., width 1.3 in."

This species in a general way resembles *A. simplex* of our coast (sometimes called *A. ephippium*, hence Gabb's name). Specimens when well preserved show a peculiar postulose exterior, the pustules in some instances becoming elongated.

Although Gabb's types are supposed to be in the Phila. Academy's collection none there show the "lower valve." This with a larger form usually referred to *lisbonensis* occurs in great abundance from the Rio Grande to the Sabine almost wherever the St. Maurice beds are represented.

Although specimens of *Anomia* are abundant in the Lower Claiborne (St. Maurice) of Louisiana, the pustulate type becomes rare and the generally larger, smooth *lisbonensis* predominates.

*Type.*—Phila. Acad. Nat. Sci.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Cornell Univ. Mus.

*Localities.*—From 13 mls below Laredo, northeastward throughout Texas to the Sabine about Sabinetown.

**Anomia lisbonensis,** Pl. 11. Figs. 6-10

*H. ephippioides* var. *lisbonensis* Ald. Bull. 1, Geol. Surv. Ala., 1886, p. 41, pl. 4, fig. 6.

*A. lisbonensis* Dall, Trans. Wag. &c, vol. 3, 1898. p. 781.

*Aldrich's characterization of lisbonensis.*—"Shell thin, pearly, suborbicular; upper valve smooth, slightly wrinkled on the umbo; lines or growth distant, hinge line doubly sigmoid, the extremities winged. Muscular scars indistinct.

*Locality.*—Lisbon and beds at base of Claiborne Bluff.

The type is externally marked with broad radiating bands of color. On comparison with *A. ephippoides* Gabb, it appears much larger and more transverse; that species is not smooth externally, and is often plicate. It occupies the same horizon however."

We have several good specimens of the larger valve of this form from these type localities, some of which are shown by the figures, 6, 7, 8. We would not be at all surprised if some of the more radiately marked specimens, from the Lisbon vicinity are the same as Conrad's *A. jugosa* although he labelled the type of that species (now in the Academy's collection) from the "White Limestone of South Carolina," The interior of that specimen seemed to us more like hard gray marl than "white limestone." Conrad's figure of *jugosa* shows the feeble ribs much too distinctly. They are remarkable for showing a down-bowing of the lines of growth as they pass over the obscure costæ.

As remarked above, the pustulose specimens of *Anomia* in our collections are Texan. The markings in *lisbonenis*, besides concentric lines of growth consist generally of microscopic hachures as shown by figure 9. There is, too, a slight tendency to show interrupted radial foliation. Figs. 9, 10 are from the same locality in N. W. Louisiana, Hammett's Branch. Fig. 10 shows how even here there is a tendency for the otherwise *lisbonensis* to become slightly pustulose in places.

*Type.*—Aldrich Coll., now at Johns Hopkins Univ.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Geol. Mus., Cornell Univ.

*Localities.*—Common in Texas with *ephippioides*; Mt. Lebanon—Hammett's Branch, Natchitoches, Chestnut, in Louisiana; Lisbon and base of bluff at Claiborne, Ala. Thin, delicate specimens of this species are common at Hamilton Bluff, Ala.

**Anomia navicellodies** var. **hammetti** Har., Pl. 12. Figs. 1, 2.

*Varietal characterization.*—Shell long-ovoid as illustrated; rather thick, very flat, somewhat curved; exterior marked by a large number of irregularly divaricating, radiate riblets having a tendency to develop minute, hollow prickles; broad, concentric undulations irregularly disposed.

Along with this upper left valve there are fragments of heavy right valves, shown on pl. 11, figures 4 and 5 that in all probability belong to this species, though we have not thus far found two valves together to prove the question beyond a doubt. These show a remarkable thickening about the opening as well as about the whole cardinal area.

*Type.*—Deposited in Pal. Mus., C. U.

*Horizon.*— St. Maurice Eocene.

*Specimens figured.*—From Hammett's Branch, La.

*Localities.*—Hammett's Branch and Bayou Negreet, La.

**Plicatula filamentosa** Con., Pl. 12, fig. 3, et. seq.

See Bull. Am. Pal. vol. 2, p. 233. Also *P. filamentosa* Dall, Trans. Wag. &c., '98, p. 762.

The appearance of radii within young shells and their gradual obscuring by calcareous thickening within is well shown by figures 4, 5 and 6. De Gregorio (Eoc. Faun. Ala., p. 179) has described a young valve like fig. 4 as "*Spondylus amussiopse.*" Exteriorly just outside the irregular attachment area, faint radiating plications appear in young forms, especially of the upper Sabine horizon. Next, strongly marked concentric lines of growth at certain regular intervals giving the appearance of fimbriate radiating lines; fourthly, deep radial folding, often mainly sub-marginal. The Sabine forms have more regular and numerous plications than the later specimens of this species. But the concentric lines with the tendency to produce ribs of a second order is already noticeable in a few specimens from Hatchetigbee.

Typical *filamentosa* must be regarded as the Claiborne form, shown by figs 3-8. A comparatively small number of plications, superposed by fine secondary rays and a strong tendency to have the hinge line extended, giving the shell an auriculate aspect are features tending to differentiate this from earlier varieties.

Variety *concentrica* Dall (Trans. Wag., p. 762.) "Is marked by a total disappearance of radial striæ and the development of fine, even, regularly spaced, concentric, elevated sculpture all over the shell." This tends to give way to the usual *filamentosa* structure when a dozen or so specimens aie examined from any one locality. (See figs. 9 and 12.)

Variety *planata* (Ald., Jr. Cin. Soc. Nat. Hist., vol. 9, 1886, p. 45, pl. 2, fig. 20) is one of the commonest forms in the St. Maurice. Here the wrinkling of the concentric lines at even intervals causing radii of various orders or dimensions, reaches the limit. So important does this feature become that the original concentric lines are practically obliterated and rows of scaly spines, hollow and long in certain rays are the dominating feature of the shell surface. See fig. 17. Large old specimens like fig. 16 often show clearly a tendency to become strongly plicate about the basal margin. These plications are however, more numerous than in the later Claiborne sand specimens.

*Types.*—*P. filamentosa* (Phila. Acad.) ; *concentrica* (U. S. Nat. Nus.) ; *planata* (Ald. Coll., J. H. Univ. Coll.)

*Horizon.*—Uppermost Sabine to Jackson.

*Specimens figured.*—Cornell Univ. Paleont. Mus.

*Localities.*—For *filamentosa*, *sen. str.*, Claiborne sands ; for *concentirca*, pre-eminently the Texas variety, common in Cherokee, Anderson, Houston and Robertson Co's ; Columbus and Negreet, Sabine Pam., La., Wautubbee, Miss. ; for *planata*, Newton, Hickory, Wautubbee, H. Johnson's, Miss. and St. Maurice, Cooper's Well, Winnfield, about 1000 ft., La.

**Pecten deshayesii** Pl. 13. Figs. 2-7.

*P. deshayesii* Lea, Cont. to Geol., 1833, p. 87, pl. 3, fig. 66.
*P. lyelli* Lea *id.* p, 87, pl. 3, fig. 67.
*P. deshayesii* de Greg., Mon. Faun. Eoc., 1890, p. 180, pl. 21, figs. 12-15.

*Lea's original description.*—Shell orbicular, rather compressed ; ears nearly equal; substance of the shell rather thick; ribs about twenty-one, large, alternating with as many small ones, all imbricate; beaks pointed.

Diam. . . Length 1.3, Breadth 1.3 of an inch

*Lea's original description of lyelli.*—Shell longitudinal, rounded below, angular above, compressed; ears very unequal, having a channel on the larger one; substance of the shell thin; ribs about twenty-two, rounded, slightly imbricate; beaks acutely angular.

Diam. . . Length .8, Breadth .7 of an inch.

There seems to be considerable uncertainty as to what, and how many species of *Pecten* really come from the Claiborne sands. Dall says regarding *deshayesii* (Trans. Wag., III, p. 738):

> "This species is positively known to occur in the Jacksonian at Claiborne and elsewhere, but I have obtained no specimens from the vast amount of marl belonging to the true Claiborne sands horizon which has come under my notice."

Cossman finds this species "excessivement rare" in his barrel-full of sand.

Our various collection at the same horizon and place, whenever at all extensive, have never failed to produce several good specimens of *Pecten* of this and perhaps other nearly related forms.

The specimens of this so-called species found in famous "sands" are very variable in outline, size and markings. What one usually finds is just what Lea described: one or more large left valves, quite highly ornamented, along with smaller right valve with simpler ribbing. The right valves seem more elongate, just as Lea remarks under his *lyelli*. Along with these, one generally secures fragments, at least, of large right valves with flat, smooth, broad ribs, regarded by some as having been worn. (See pl. 13, fig. 8.)

The right valve while young possesses a very prominent anterior byssal ear with a deep notch, and a broad shallow groove extending to the beak, also about 5 imbricate rays; posterior ear much smaller, forming an angle of approximately 90 degrees with the hinge line and having about 5, often double, rays; general shell surface with ribs equalling interspaces in width, about 18 well defined ribs on the face of the shell, with half a dozen or so fine radiating lines or subdivided riblets on the lateral umbonal margins ; surface ornamentation, imbricate concentric lines ; ribs often showing an incilnation to bifurcate on marginal areas, at least a deeply incised line is often seen on the tops of the ribs in these regions ; near basal margin there is a tendency to show obscurely, however, three raised lines on top of main ribs and one or three lines in the inter-costal area.

Left valve while young showing markings similar to those described above, with more nearly equal ears, however, and a tendency to show at an earlier age three lines on top of the ribs; and a strong line (often between two others) between the ribs , irregularities like subdivision of costæ, increasing comparative width of interradial spaces, great increase in radiating, fimbriate lines on top of ribs on their sides and in interspaces, apparent; shell deepening rapidly with age.

Occasionally on certain portions of the exterior of the left valve a strong bi-partite structure is seen in the ribbing. This has given rise to the varietal name *tirmus* by de Gregorio. We do not think it of even varietal rank.

Concerning the type of *deshayesi* in the Phila. Acad. it may be noted that it shows 20-22 primary, with as many inter-ribs ; the latter apt to be on the anterior side of the intercostal space ; traces of tertiary riblets ; few signs of riblets superimposed on primary ribs ; finely, evenly crinkled, concentric incised lines on ears.

The type specimen of *lyelli* has about an equal number of ribs ; but slight traces of intercostæ and concentric line ; ribs not showing bifurcation as plainly as is indicated by fig 7, pl. 13 of this work.

*Types.*—Philadelphia Acad. Coll., Cat. Nos. 5425, 5426.

*Localities and Horizon.*—Typically in the Claiborne sand horizon. A specimen seemingly of the *lyelli* form is in our collection from the Orangeburg district, S. C.

*Specimens figured.*—Collections at Cornell Univ.

**Pecten wautubbeanus** Dall, Pl. 14. Figs. 1, 2, 3, 4.

*P.* (*Chlamys*) *wahtubbeanus* Dall, Trans. Wag. &c, 1898, vol. 3, p. 736, pl. 34, fig. 9.

*Dall's original description.*—Shell small, flattish, with small, unequal ears and rounded disk ; fourteen or fifteen ribs carrying basally three densely finely imbricated, rounded threads, the interspaces narrower with two crenulate threads; submargins with close, fine, imbricate threads ; ears prominent, with a deep wide, byssal notch, radiately imbricate with coarse elevated radial threads ; interior with shallow sulci, the cardinal crura developed but no liræ on the disk. Alt. 22, lat. 22 mm.

This species differs from the Clabornian* *P. deshayesii* Lea by its threaded and less individualized ribs, its similarly sculptured valves, more conspicuous notch, and concentric sculpture and smaller size when adult.

We have emended the spelling of this species, the "h" having crept into the name from bad orthograpy of the collector. Dall states that this species is "abundant at Wautubbee." Our collections furnish many fine specimens from Wautubbee, but we scarcely feel like giving it the wide geologic range implied in "Claibornian and Jacksonian of Louisiana, Alabama and Mississippi."

This species is extremely variable in appearance, even at the type locality. The right valve seems to be far more abundant and is flatter than the left and is more apt to assume a worn appearance (see fig. 1). While the ribs, about the periphery in the right valve, nearly always show the tri-partite markings described by Dall, such secondary ornamentation on the left valve are far less conspicuous though present on the lower margin of the shell (see fig. 3). On the type specimen, however, such markings are well defined.

Whenever the middle one of the three riblets is strongest, then, whether the rib be worn or intact, it apears narrow. Whenever the lateral riblets are well developed the rib has a broad appearance and the interspaces seem narrow and deep. In extreme cases the riblets are not distinctly developed but the imbricate lines of growth are well defined. The general aspect of the shell is accordingly greatly changed. Quite often, however, after a very marked growth line, the tri-partite ornamentation reappears. A very gibbose, perhaps somewhat pathologic specimen in our collection from near Negreet P. O., La. shows this feature in a remarkable degree. The broad ribbed variety we have named *cainei*, see below. Also see fig. 8, type of variety. From the *sellæformis*, light-colored layers near the base of the bluff at Claiborne thin, varietal forms are found, one of which herewith figured (fig. 5) is quite as large as the average *deshayesi* from the sends above. It is characterized by the scaly spinosity of the bipartite ribbing shown on valves of *willcoxi* Dall (fig. 6), and described also as *deshaysei* var. *tirmus* by de Gregorio.

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*Note that on p. 738, Trans. Wag. III no Pectens are known from the Claiborne sand.

The intimate relationship of some forms of *deshayesi* and *wautubbeanus* may also be noted by the fact that the usual small right valves generally known as *lyelli*, in the collection of the U. S. Nat. Mus., No. 116,012, are classed as *wautubbeanus*.

*Type.*—U. S. Nat. Museum.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Wautubbee and Hickory, Miss. var.; fig. 5 from base of bluff at Claiborne.

*Localities.*—Simpkins place, 3 mls S. E. of Negreet, and St. Maurice, La; Wautubbee, Hickory, 8 mls W. of Enterprise, Miss.; 3 mls S. W. of Orangeburg, S. C.; Coffeeville, base of bluff at Claiborne, Ala.

**Pecten** (**wautubbeanus** var?) **willcoxi** Dall, Pl. 14. Figs. 6, 7.

*P.* (*Wautubbeanus*) var. *willcoxi* Dall, Trans. Wag. &c., vol. 3, 1898, p. 737, pl. 29, fig. 4.

*Dall's original description*—Shell small, broad, flattish, thin; left valve with about sixteen narrow, rounded, elevated ribs, with somewhat sparse, regularly spaced prickles on their tops; between the ribs are similar, but lower and smaller, non-dichotomous radial threads; submargin very narrow, nearly plain, with faint *Camptonectes* striation; ears small, subequal, except the byssal ear, which is longer, narrow, with a deep sinus and conspicuous fasciole, and about sixty scabrous radii, the right posterior ear with concentric striæ and only faint traces of a few radii; the ears on the left valve similar, with five or six strong scabrous threads; internal basal margin of left valve with short flutings in harmony with the radial sculpture; the disk not grooved; in the right valve the internal channels are more pronounced; the right hinge line has a single crural ridge parallel with the margin on each side of the pit. Alt. 23, lat. 24 mm.

This form is closely related to *P. wautubbeanus*, from which it differs by the isolated character of the prickles on the ribs, which are replaced in *wautubbeanus* by more or less continuous concentric lamellation, while the ribs of the right valve of the latter are more or less split up, but in *P. willcoxi* present the appearance of a fascicle of separate threads. In worn specimens of *wautubbeanus* the ribs appear rounded and plain after the removal of the scales; in *willcoxi* the division into threads is distinct. Nevertheless it is possible that a larger series may show the two forms to be merely the extremes of a single species. From *P. membranosus* the present form is easily distinguished by wider hinge line, larger ears, thinner shell, and by its radial threads fasciculated rather than subequally level.

We have given Dall's statements in full regarding this form for but few specimens seem to have been included in any of our collections. The specimens figured were loaned from the U. S. Nat. Musenm through Dr. Dall and came from "Clark Co.", Miss.

*Type.*—U. S. Nat. Museum.

*Horizon.*—St. Maurice Eocene.

*General distribution.*— "Eocene of Clark Co., Miss., and of the Wautubbee Hills (Claibornian); Johnson and Burns."—Dall.

Variety **cainei** n. var., Pl. 14, Fig. 8.

This is characterized by the broad, simple ribs ornamented with densely arranged, imbricate concentric lines.

Named in honor of T. A. Caine, a former student who collected a large amount of material from eastern Miss.

*Type.*—C. U. Collection.

*Horizon.*—St. Maurice Stage.

*Localities.*—Wautubbee and Hickory, Miss.

**Pecten pulchricosta** Ald. and Mr., Pl. 14, Figs. 9, 10.

*P. pulchricosta*, Ald. Mr., Jr. Cinn. Soc. Nat. Hist., vol. 9, 1886, p. 45, pl. 2, fig. 23, a.

*P. pulchricosta* Dall, Trans. Wag., 1898, p. 730.

*Ald. and Meyer's original description.*—Convex, covered by eight broad, rounded, radiating ribs. perceptible in the inside; those in the middle are largest. Near the ventral margin they dissolve into more numerous ribs. Wautubbee: only the figured valve is known.

Dall has increased our knowledge regarding the specific characters of this species from National Museum material. He says:

"Shell small, thin, with eight large ribs, which near the umbo are divided by one or two well-marked sulci, which soon become obsolete, after which the ribs are simple; the surface sculpture is of even, uniform, crowded, concentric elevated lines. The ears are subequal, the byssal notch well marked".

The sulci mentioned by Dall are caused by a tendency on one or both sides of the big ribs to form secondary riblets. This is especially noticeable near the umbo, but reappears near the margin as implied by Aldrich and Meyer's description.

We do not find the number eight so rigidly fixed for the ribs as former descriptions imply. *Pecten clavatus* of the Mediterranean is closely allied to this form. Aldrich and Meyer seem to have had only the right valve; Dall, only the left. By a slight *lapsus* in the latter's work it is referred to the Jacksonian Eocene.

*Type.*—Aldrich Coll., Johns Hopkins Univ. Mus.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Cornell Univ. Mus.

*Locality.*—Wautubbee.

**Pecten clarkeanus** Aldrich, Pl. 15. Figs. 8-13.

*P. clarkeanus* Aldrich. Bull. Am. Pal., vol. 1, p. 68, pl. 6, fig. 11, 1895.
*P. frontalis* Dall, *partim*, Trans. Wag., III, p. 753, '98

For Aldrich's original description, see Bull. Am. Pal., vol. 1, p. 68, as cited above.

This is a remarkably interesting and variable species as Aldrich has already pointed out. The vast number of young or small forms show the beautifully fine and distinct radiation about the umbo though with but slight traces of radiate sculpturing over the general surface of the shell (figs. 10, 12). *Camptonectes* marking is, however, well defined. Occasionally the radiate sculpturing expands and lengthens and covers the entire surface of the shell (figs. 8, 13). Again it appears about the margins only (fig. 9.) The shell substance is thin, and as Aldrich remarks, recalls *P. scintillatus.* At the type locality only, Sowilpa Cr., have we observed (in specimens kindly loaned by Aldrich) the particular form of ribbing shown on pl. 6, vol. 1 of these Bulletins. (See also pl. 15, fig. 8, of the present work). Even these specimens are not so thick and solid looking as the figure perhaps suggests. This fact has doubtless led Dall to consider a much more rugged form from the Brazos River, Tex., as true *clarkeanus* (Trans. Wag. III, 739, '98).

Not unfrequently valves of this species show a faint, broad. quinque-costate structure (see figs. 10 and 11).

Small specimens of this species in the Academy Collection are labelled *P. frontalis* Dall. This name Dall gave to take the place of *P. rogersi* Clark which was pre-occupied. (See Trans. Wag., pp. 731 and 753). Of the equivalency of this Virginia form and others from the Jackson of Miss. we cannot speak with authority. Clark noticed his *lapsus* and renamed his *rogersi*, *P. dalli*, though just after Dall had proposed the name *frontalis*. The Va. forms are doubtless closely allied to *clarkeanus*, but Aldrich's name has three years priority over Dall's and Clark's.

*Type.*—Aldrich Coll. Johns Hopkins Univ. Coll.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—C. U. Coll.

*Localities.*—Sowilpa Cr. in type form (figs. 8 and 9). At Hamilton Bluff and Lisbon often in abundance as small, almost smooth, very thin and *scintillatus*-like specimens, though sometimes large and smooth or sometimes with evident costation.

**Pecten** (**clarkeanus**? var.) **burlesonensis**, n. var., Pl. 14. Figs. 11, 12, 13.

*P.* (*Chlamys*) *clarkeanus* Dall, Trans. Wag. III, p. 739, '98.
*P. deshayesii* Heilp., Proc. Phila. Acad. Nat. Sci., 1890, p. 403.
*P. deshayesi* Kennedy, Proc. Phila. Acad., &c., '95.

This is the form in Texas that has usually passed under the name of *deshayesi* in reports on Eocene paleontology of the State, but it is really much more nearly related to *clarkeanus* as described elsewhere in these Bulletins. However, it is generally somewhat higher, or narrower with a less expanding umbonal angle, thicker or heavier, and with more pronouncedly radiately sculptured than *clarkeanus*. The surface about the umbones when smooth have a somewhat worn appearance without the fine umbonal radiation and the Camptonectes marking so well shown in *clarkeanus*. The only reason for referrring this to *clarkeanus* at all, is that, although it is generally of the rather sharply ribbed type, it does show, say at Burleson's Bluff, a vast range in surface markings both as to number, strength and extent of ribs. In this respect it resembles *clarkeanus*. It will be interesting to note in the future the characteristics of the related types found in Louisiana and Mississippi.

*Type.*—Burleson Shell Bluff, C. U. Mus.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Fig. 11, loaned from U. S. Nat. Mus. Figs. 12, 13, deposited in C. U. Paleont. Mus.

*Localites.*—Burleson Shell Bluff, Collier's Ferry or Black Bluff shoals and Smithville, Tex.

**Pecten cawcawensis**, n. sp., Pl. 16. Figs. 1-7.

*Specific characterization.*—Size and outline as indicated by the figures; surface ornamentation,—about 23 ribs on each valve, broad with narrow interspaces on the right, narrower with wider interspaces on the left; rarely 'signs of intercostæ on the right, common on the left; imbricating, fine, concentric, lamellæ more pronounced on the right valve.

This form has usually passed under the name of *deshayesi*, but it will be seen by examining pls. 14 and 15 that the ribs of *cawcawensis* are much more sharply defined and differentiated and lack the excessive ornamentation of superimposed riblets with scaly imbrications in high relief. However, both are of the same stock and doubtless will seem to intergrade when enough material is collected from a large number of Mid-Eocene localities.

*Types.*—Paleont. Mus., Cornell Univ.

*Horizon.*—St. Maurice Eocene.

*Localities.*—Columbia Road, 17 mls N. of Orangeburg, S. C. (not far from Cawcaw Swamp); Claiborne, Ala? (see pl. 13, fig. 8). Above Newbern, Neuse River, N. C.

Specimens from a locality numbered 5,205 in the U. S. Nat. Mus. Catalogue (Flint River, old Danville Ferry, 16½ mls E. of Americus, Ga.) labelled *deshayesi* are more probably varieties of *cawcawensis*.

**Pecten scintillatus** var. **corneoides,** n. var., Pl. 15. Figs. 15, 16.

*Pseudamusium claibornense* Har., *partim*, Bull. Am. Pal., vol. 2, p. 235, pl. 13, fig. 1.

*P. calvatus* Dall (non Mort), *partim*, Trans. Wag., III, 98, p. 752.

*P. scintillatns* Dall, *partim*, id., p. 752.

*Specific characterization.*—Form and size as indicated by the figures (see also fig. in Bull. Am. Pal. referred to in the synonymy) ; substance of the shell thicker when adult than in *scintillatus* of the Jacksonian ; appearance like that of *corneus* of England, though smaller ; surface practically without markings save the fine concentric lines of growth and a few radiating rays on the anterior ear, such rays when adult, separated by a rather broad, smooth space from the anterior margin of the shell as indicated in fig. 16 ; posterior ear in adult shell with exterior angle ap-approximating 90° and not so obtuse as in *scintillatus* (fig. 14) nor so acute as in *calvatus* ; young shells in Mississippi, St. Maurice stage, approaching close in outline to *scintillatus*, but here as elsewhere so far as observed no Camptonectes marking (so finely shown in *scintillatus*) have been observed ; left valve very flat in umbonal region, becoming deeper centrally and basally, with a faint, medial fold rapidly expanding basally.

*Type specimen.*—The Hatchetigbee specimen figured in Bull. Am. Pal, as cited above.

*Horizon.*—Sabine and St. Maurice.

*Specimens figured.*—Deposited in C. U. Mus., St. Maurice.

*Localities.*—Three miles E. of Alto, Cherokee Co., near Crockett, Houston Co., Tex. St. Maurice, Winnfield Marble Quarry and Hammett's Branch, La. Hickory and Wantubbee, Miss. Hatchetigbee, and base of bluff at Claiborne, Ala.

Specimens of this form from Enterprise Miss., in the U. S. Nat. Museum, No. 137,665, are labelled *P. scintillatus*.

**Amussium squamulum** Lamarck ? Pl. 15. Figs. 17, 18.

For synonymy and discussion see Bull. Am. Pal., vol. 2, p. 1897, p. 236.

In the St. Maurice stage as exhibited about the mouth of Negreet Bayou, La., there are often many badly preserved specimens very similar apparently to these we have referred to heretofore as *A. squamulum*. They are, however, about 40 per cent larger than the Woods Bluff specimens, are perhaps a little more regularly inflated, and have the interior ribbing extending not so near the lower margin.

*Specimens figured.*—Negreet Bayou, La; deposited in Paleont. Mus., Cornell Univ.

**Lima harrisiana** Aldrich, Pl. 16. Figs. 1, 2.

*L. harrisiana* Ald., Nautilus, vol. 24, 1910, p. 74, pl. 4. figs. 10, 11.

*Aldrich's original description.*—Shell oblong, slightly oblique, radially sculptured, covered with close-set lines slightly nodular; between them in the sunken spaces are fine dotted lines which die out towards the hinge line and umbo. The ribs are very numerous, near the umbo on one side they appear quite nodulous; ears very unequal, hinge nearly straight, but somewhat inclined to the central axis. In a young specimen the ribs appear to be nodulous and the inner margin denticulated.

Longest axis 17 mm.

*Locality.*—Smithville, Texas.

*Remarks:* This species seems to be rather close to *L. vicksburgiana* Dall, but has many more ribs, over 50 in all.

We have found one specimen belonging to this genus in the Mid-Eocene of America and that is the one herewith figured. The *L. ozarkana* described by us in a former Bulletin from the Sabine stage belongs to quite a different type of *Lima*.

*Type.*—Aldrich collection.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Deposited at Cornell.

*Localities.*—Smithville, Tex.; Atlanta road six miles W. of Winnfield, La., S. E. of the so-called Marble Quarry.

**Spondylus** sp.

Accompanying the Winnfield specimen of *L. harrisiana* is a fragment of *Spondylus* of *dumosum* type but too imperfect for further characterization.

**Pteria limula** Conrad, Pl. 16. Figs. 3-7.

*Avicula limula* Con., Foss. Sh. Tert. Form., Oct. 1833, p. 39.
*A. clabornensis* Lea, Cont. to Geol. Dec. 1833, p. 86, pl 3, fig. 65.
*A. claibornensis* de Greg., Mon. Faun. Eoc.. 1890, p. 183, pl. 22, fig. 4.
*A. cardincrassa* de Greg., Mon. Faun. Eoc., 1890, p. 184, pl. 22,

figs. 1-2.

*Conrad's original description.*—Shell convex, with slight concentric undulations; umbo tapering gradually towards the apex, which is acute, but not prominent; wings large and very oblique; sinus of the posterior margin not profound; nacre very pearly and irridescent. Height 1¼ inches.

This species seems to vary considerably in obliquity, and thickness of shell. It seems never to occur in perfect condition; generally only the thicker, umbonal region is found. By examining the fragments, however, it becomes apparent that the wing was quite pointed; rudiments of cardinal teeth in left valve obvious; ligament submergent, broad.

*Type.*— Phila. Acad. Nat. Sci.

*Geological horizon.*—Claibornian and St. Maurice, and perhaps Sabine Eocene. None with the thickening of the valves shown by the figures on pl. 16 (figs. 3-7) have come to the writer's attention from horizons below the Claibornian.

*Specimens figured.*—Claiborne sands, Paleont. Mus. Cornell Univ.

A fairly perfect specimen of a left valve, thinner and much more erect, possibly of this species, has been found 2 miles W. of Crockett, Houston Co., Tex. Coll. Univ. of Tex.

**Pinna gravida**, n. sp., Pl. 16. Fig. 8-11.

*Specific characterization.*—Shell moderate in length, but of extreme convexity, giving a cross-section half way from beak to posterior almost a circular form; nearer the beak the cross-section appears to be elliptical, wider than high. Markings on shell rarely of sufficient strength to show through on cast of interior (usually the only form in which the species is found). Rarely on imprints of exterior a few radiating raised costæ are shown on the superior part of the shell, while commonly concentric undulations are seen near the basal portion. (Compare form with *P. vexillum* Born. Recent.)

*Type.*—Deposited in Paleont. Mus. Cornell Univ.

*Horizon.*—St. Maurice Eocene.

*Locality.*—St. Maurice, La. Fragments of what appear to be of this species are abundant in the St. Maurice of Texas.

**Pinna cawcawensis**, n. sp., Pl. 17. Figs. 1, 2.

General shape and size indicated by fig. 1 ; surface of the valves with numerous radii above, well defined ; below with concentric undulations upon which are superimposed even more radiating costæ than above, but they are less distinct. Zigzag bases of fimbriate folds upon the ribs precisely as in the living *squamosissima* Phil., or *seminuda* Lam. (pl. 16, figs. 12-13).

In outline this is like *jacksoniana* Dall, or *argentea* Con. The Claiborne sand, Jackson and Vicksburg specimens, however, so far as our specimens show, had no well-developed dermal, semicircular spines, and too, the radii on the lower portion of the shell are fewer than above, and of uncertain direction.

*Type and specimens figured.*—Deposited in the Paleont. Mus. Cornell Univ.

*Horizon.*—St. Maurice Eocene.

*Locality.*—Five miles N. of Orangeburg, Columbia Road, S. C.

**Pinna** sp.

Several fragments of a *Pinna* very similar in form to *cawcawensis*, *argentea* and *jacksoniana* are in our collections from the Claiborne sand beds. Their surface characters are too imperfect to admit of specific description.

Aldrich (Bull. 1, Geol. Surv. Ala. 86, p. 49) refers to *Pinna* "very large" at Coffeeville. Ala.

**Modiolus cawcawensis**, n. sp., Pl. 17. Figs. 3, 4.

*Specific characterization.*—Size and form as figured ; inflated along a well defined umbonal ridge anteriorly, becoming less ventricose from the center of the shell posteriorly ; posterior broadly and evenly rounded ; exterior with generally fine but more or less variable concentric lines of growth.

In general outline this shell recalls *N. ducatelii* of Maryland Miocene, but is broader posteriorly and without the remarkable concentric fold on the anterior of that species.

It is far less angulated as to umbonal slope and posterior extremity than *cretacea* of Conrad.

*Type and specimen figured.*—Paleont. Mus. Cornell Univ.

*Horizon.*—St. Maurice Stage.

*Locality.*—Columbus road, 5 miles N. of Orangeburg, S. C.

**Modiolus (Mauricia) houstonius** Harris, Pl. 17. Fig. 5-a.

*Modiola houstonia* Har., Proc. Phila. Acad. Nat. Sci., 1895, p. 46. pl. 1, fig. 1.

*Lithophaga houstonia* Dall, Trans. Wag. , III, '98, pp. 798, 801.

**Mauricia**, n. sub. gen.

Spathella-shape, with undulations on post-umbonal slope, dying away on area below the ridge ; fine radii upon and above the ridge ; *Brachidontes* radii on the anterior ; shell thin, perlaceous.

*Harris's original description of houstonia.*—General form of shell as figured ; thin, showing concentric lines of growth on the area below the umbonal ridge ; above the same with broad, concentric undulations, becoming more numerous towards the umbones ; anterior radially striate.

We cannot accept Dall's reference of this peculiar form to *Lithophaga* becaue of : 1st, the well defined umbonal ridge ; 2d, the radiating lines medially, and the stronger ones on the anterior, and 3d, the total lack of the encircling or zonal sculpturing so common in *Lithophagæ* and evidently a result of rotary motion in their excavations.

*Type and specimens figured.*—Texas Univ. Coll. Mus. No. 145.

*Horizon.*—St. Maurice Eocene.

*Localities.*—Three miles N. E. of Crockett, Houston Co., Texas ; Chautauqua, La. ; 5 miles N. W. of Orangeburg S. C.

**Modiolus texanus** Gabb, Pl. 17. Figs. 6, 7.

*Perna texana* Gabb, Proc. Phila. Acad., 1861, p. 371.

*Modiola texana* Har., Proc. Phila. Acad., 1895, p. 46, pl. 1, fig. 2.

*Gabb's original description.*—Elongated, subtriangular. Beaks terminal, small ; umbones prominent, though small ; anterior end rounded, narrow ; cardinal margin straight, basal broadly sinuous ; posterior basal angle abruptly rounded ; posterior edge broadly convex, uniting with a regular curve with the cardinal line. Umbonal ridge high, convex ; anterior slope abrupt and slightly convex near the margin towards the beak, between which convexity and the ridge is a slight concavity ; posterior slope regular.

Surface covered by numerous, radiating, dichotomous ridges, flattened above, separated by deep depressions and crossed by fine lines of growth. These ribs almost disappear on the anterior umbonal slope for about the marginal half of its width.

Length from beak to posterior angle, 2 inches. Width at a right angle to the first measurement, .9 in. Depth of valve .4 in.

From a coarse brown highly fossiliferous Eocene sandstone from Caddo Peak, Texas. My collection, from Dr. Moore, State Geologist of Texas.

The one thing most characteristic of the specimens we have referred to this species is the presence of a few, very strong costæ at the extreme anterior, somewhat as figured by Deshayes under *M. spatulata* (see fig. 7).

It is quite possible that some, at least, of the many *Modiolus* fragments from near Grovetown, Ga., (Bull. 16, p. 6) one of which is herewish figured (fig. 8), should be referred to *texanus*. Near the margins of the shell there seems to be less dichotomosing of the costæ, however, than shown in *texanus*.

*Type.*—Phila. Acad. Collection.

*Geological horizon.*—St. Maurice Eocene.

*Specimen figured.*—From near Red Land, La ; (U. S. Nat. Mus. Sect. 19, R 12 W ; sp. 23, N.—Harris).

*Localities.*—Caddo Peak, 2 miles S. W. of Campbellton, Atascosa Co., 2 miles E. of Arnold's Ranch, Frie Co., Tex. ; near Red Land, Vivian, and 7 miles N. of Plaindealing, La.

Specimens from No. 7724, U. S. Nat. Mus., McBean, 3.7 miles S. of Hephzibah, Burke Co., Ga. are probably *texanus*.

**Modiolaria alabamensis** Meyer, Pl. 17. Fig. 9.

*M. alabamiensis* Meyer, Bull. 1, Geol. Surv. Ala., 1886, p. 83, pl. 3, fig. 19.

*Meyer's original description.*—Rhomboidal, thin ; the small anterior and large posterior part with radiating ribs, leaving the middle of the shell and the umbo smooth ; hinge edentulous, anterior hinge-line notched.

*Locality.*—Claiborne, Ala. ; "Lowest Claibornian."

The figured type is a young shell.

We have found nothing like this in our collections and hence quote Meyer *verbatim* and reproduce his figure. We cannot help feeling that this may be the young of *M. texanus*. Dall, however, refers to it (Trans. Wag. III, '98, p. 806) as "a well characterized species.

**Lithophaga claibornensis** Conrad, Pl. 17. Figs. 10, 11.

*Lithodomus claibornensis* Con., Jr. Phila., Acad. Nat. Sci., vol. 1, p. 132, pl. 14, fig. 27, 1848.

*Lithophaga claibornensis* Con., Amer. Jr. Conch. , vol. 1, 1865, p. 11.

*Lithodomus claibornensis* Ald., Bull. Amer. Pal., vol. 1, p. 69, pl. 6, fig. 14.

*Conrad's original description.*—Very thin and fragile, inflated ; posterior hinge margin obliquely truncated, the extremity regularly rounded ; lines of growth distinct.

*Locality.*—Claiborne, Alabama.

We give herewith as fig. 11 a copy of Conrad's figure in the Journal of the Philadelphia Academy. The type specimen, about 1 by ¼ in. long is still in the Academy's Collection. Likewise another, rather cylindrical fragment. Aldrich's figure, here given as fig. 10, has a somewhat different form from Conrad's, but regarding this matter he makes no comments.

This must certainly be regarded as one of the most rare species at Claiborne. Gregorio, Cossmann, Dall and ourselves have had access to no new material.

**Lithophaga petricoloides** Lea, Pl. 17. Figs. 12, 13.

*Byssomia petricoloides* Lea, Cont. to Geol., 1880, p. 48, pl. 1, fig. 16.

*Lithodomus petricoloides* De Greg., Annal. de Geol., et Pal., 1890, p. 184, pl. 22, figs. 7 and 8.

*Lea's original description.*—Shell subcylindrical, very thin, very transverse, indistinctly striate, on the posterior part obliquely and obsoletely folded ; beaks scarcely perceptible ; posterior and anterior cicatrices perceptible.

Diam. . . . Length .1. Breadth .3 of an inch.

*Observations.*—With much doubt I have placed this shell in Cuvier's genus *Byssomia*. It agrees better with his description of that genus than any one I know. Unfortunately I have obtained but a single valve and that is imperfect. It has a strong resemblance to *Petricola pholadiformis* (Lamarck) (*P. fornicata*, Say), but is to appearance entirely without teeth, having several irregular folds about the beak. It differs also in the exterior folds or ribs, which are, in the *pholadiformis*, marked and situated on the anterior part.

The figures herewith given are from de Gregorio. He seems to have found some nearly perfect valves. The generic position of this form is still in some doubt. Fragments in our collection are not perfect enough for further determinations.

*Type.*—Lea Coll., No. 5074, Phila. Acad.

**Crenella latifrons** Conrad, Pl. 17. Figs. 14, 15, 16.

*Crenella latifrons* Con., Jr. Phila. Acad. Nat. Sci., vol. IV, 1860, p. 296.

*C?-latifrons* Con., Amer. Conch., vol. 1, 1855, p. 11.

*Conrad's original description.*—Obliquely sub-oval, inflated, thin, highly pearlaceous; anterior side produced or alated above; striæ very closely arranged, elegant and minute, cancellate anteriorly.

*Locality.*—Alabama. Dr. Showalter.

Otto Meyer described (*Bericht üb. d. Senckenbergische nf. Gesel. in Frankfurt a. M., 1887, p. 10 sond.-Ab.*) a *Modiola teuuis* and figured the same as fig. 7 and pl. 2 of his report, from the Jackson Eocene. This, Dall maintains is the same as Conrad's *Crenella latifrons*. (See Trans. Wag., III, p. 798.) This is quite possibly true. But Meyer strangely makes no reference to the radiating lines so clearly defined in the Clabornian species. We have several fragmentary specimens before us mostly from the U. S. Nat. Mus. Claiborne sand material. Some we herewith figure.

Perhaps the most noteworthy feature of the species is the broadly out-folding anterior margin of the shell.

The radiating striæ are very much finer than in *margaritacea* and do not show on the margins.

*Type.*—Claiborne sands, Phila. Acad.

**Crenella margaritacea** Conrad, Pl. 17. Figs. 17-20.

*Stalagmium margaritaceum* Con., Foss. Sh. Tert. Form, Oct., 1833, p. 39.

*Myoparo costata* Lea, Cont. to Geol., Dec. '33, p. 74, p. 74, pl. 2, fig. 51.

*Stalagmium margaritaceum* Con., Jour. Conch., 1865, p. 10.

*Crenella costata* de Greg., Faun. Eoc. Ala., 1890, p. 185, pl. 22, figs. 8-14.

*Crenella margaritacea* Dall, Trans. Wag., III, '98, p. 803.

*Conrad's original description.*—Shell very small, ob-ovate, convex, with distinct, radiating striæ; beaks prominent and curved forward; lunule short, cordate, slightly impressed; inner margin minutely crenulated.

Specimens of this minute valve are not rare at Claiborne, but we have seen it from but one other locality—Lee Co., Tex., in the Aldrich Collection.

*Type.*—Lost.

*Specimens figured.*—Paleont. Coll. Cornell Univ.

**Crenella isocardioides** Lea, Pl. 17. Figs. 22-24.

*Hippagus isocardioides* Lea, Cont. to Geol., 1833, p. 72, p. pl. 2, fig. 50.
*Hippagus isocardioides* de Greg., Mon. Faun. Eoc. Ala., p. 226, pl. 35, figs. 22-28.
*Crenella isocardioides* Dall, Trans. Wag., III, '98, p. 803.

*Lea's original description.*—Shell cordate, much inflated; longitudinal, minutely and longitudinally ribbed, flattened before and behind, ridged along the umbonal slope; substance of the shell rather thick; beaks large, recurved; cicatrices impressed; cavity of the shell very deep; margin minutely crenulate; nacre somewhat pearly.

Diam 3-20ths, Length 5-20ths, Breadth 3-20ths of an inch.

The exterior marking on this minute species is very faint. I have seen none so well preserved that the marginal crenulations show, nor have I seen it elsewhere than at Claiborne.

*Type.*—Phila. Acad. Coll.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

**Limopsis aviculoides** Conrad, Pl. 18. Figs. 1-7.

*Pectunculus aviculoides* Con., Foss. Sh. Tert. Form, Oct., 1833, p. 39.
*Pectunculus obliqua* Lea, Cont. to Geol., 1833, p. 78, pl. 3, fig. 57.
*Limopsis aviculoides* Con., Jr. Phila., Acad. vol. 5, p. 297, pl. 47, fig. 12.
*Limopsis obliqua* Cossm., Notes Compl., 1893, p. 16.

*Conrad's original description.*—Shell sub-oval, very oblique, with minute radiating lines interrupted by regular, prominent, concentric striæ; umbo prominent; beaks rather elevated; apex acute; series of cardinal teeth interrupted in the center by a triangular fosset; cavity capacious, margin crenulated. Length ⅓ of an inch.

So far as our knowledge of this species goes it appears to be mainly confined to the central part of the Mississippi Embayment,—Louisiana and Mississippi produce the greater percentage of specimens. The Claibornian specimens are few and comparatively small. Several years' collection by members of the Geological Survey of Texas brought to light no specimens.

Conrad must have had an unusually large specimen for Alabama in describing the type.

*Type.*—From Claiborne, Phila. Acad. ; Con. Coll.

*Horizons.*—St. Maurice (abundant and large specimens; Claibornian, few and and small specimens.)

*Specimens figured.*—Figs. 1, 3, 4, 5, St. Maurice, La. ; Fig. 2, Hickory, Miss ; figs. 6, 7, Claiborne sands, Claiborne, Ala. All at Cornell.

*Localities.—Louisiana :* Sabine R., S. E. cor. Tp. 5 N. R. 13 W. ; St. Maurice ; well at Atlanta ; Winnfield, Ruston, Calvin, Winona, Columbus, Marble Q'y. *Miss.:* Wautubbee, 8 miles N. E. of Enterprise ; Hickory. *Alabama :* Claiborne sands, Claiborne Bluff.

### Genus **TRINACRIA**

On account of the varying outline of species belonging to this genus the word *Trinacria* is somewhat misleading: Specimens may vary from cuneate forms with a sharply defined umbonal ridge to those ellipsoidal or nearly circular. Still there are many features common to them all, and it seems impossible to form natural subgeneric groups. The following constant features may be noted : Taxodont hinge curved, Glycymeris-like, very short in pointed shells, lengthening in transverse shells ; pit beneath the umbo triangular, developed almost wholly anteriorly from the beak ; narrow and deep in cuneate forms, widely expanded and vertically contracted in broader forms ; exterior marked with fine radiate striations usually stronger in the gibbose species, almost obsolete in the flattish ; posterior with always a hint of truncation with a post-umbonal ridge and slope,—features which when projected in a post-basal direction bring about the strong cuneate, carinate outlines already referred to. The outline of these Eocene species being so various has caused them to referred to several different genera by different authors (see the various synonymies below), but we see no good reason for subdividing a natural group.

**Trinacria cuneus** Conrad, Pl. 18. Figs. 8, 9.

*Pectunculus cuneus* Con., A. J. Sci., vol. 33, p. 342., Jan. 1833.

*Nucula carinifera* Lea, Cont. to Geol. Dec. 1833, (Dec.) p. 198, pl. 6, fig. 212.

*Limopsis cuneus* Con., Jr. Acad. Nat. Sci., vol. 4, 1860, p. 297, pl. 47, fig. 17.
*Trigonocœlix cuneus* Con., Amer. Jr. Conch, vol. 1, '65, p. 12.
*Limopsis* (*Trigonocœlia*) *cuneus* de Greg., Mon. Faun. Eoc. &c., 1890, p . 191, pl. 23, fig. 28 b.
*Trinacria cuneus* Cossmann, Notes Suppl., 1893, p. 15.

*Conrad's original description.*—Shell cuneiform, broad, posterior end flattened and forming an angle at the umbonial slope. Length, half an inch. This is a very remarkable species very unlike any I have hitherto seen.

*Locality.*—Claiborne, Ala., *London clay.*

This is the most cuneate of the American Eocene species of this genus and is closely allied to certain Paris Basin forms. A close study of the beaks and ligamental pits in this and the foreign representatives is sufficient to prove that we have here simply one extreme in a long series of species, all really closely akin. The shortness of the series of hinge teeth is brought about by the pointed umbones ; the beaks are really opisthogyrate ; the pit is anterior to the beak as developed and is necessarily deep to possess the required volume in such a contracted space ; radii noticeable anteriorly and posteriorly.

The sperimens figured are from the Claiborne sand.

In Bull. 1 of the Ala. State Geol. Surv. Aldrich has starred this in the Lisbon column (and not the Claiborne) but all specimens known to me are from the 17 ft. "sand" bed.

*Type.*—Phila. Acad. Coll.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

**Trinacria ledoides** Meyer, Pl. 18. Figs. 10 a.

*Trigonocœlia ledoides* Meyer, Bull. Ala. Geol. Surv., No. 1, 1886, p. 79, pl, 1, fig. 20.
*Limopsis* (*Trigonocœlia*) *ledoides* de Greg., Mon. Faun. Eoc., Ala., 1890, p. 191.
*Trinacria ledoides* Dall, Trans. Wag. &c, vol. III, p. 604.
*Trinacria ledoides* Cossmann, Ann. de Geol. and Pal., 12th liv., 1893, p. 15.

*Meyer's original description.*—Convex, ovate ; posterior side carinated ; hinge narrow, divided by a minute pit ; about eight teeth on each side ; more vertical near the pit, more horizontal near the end ; surface with concentric lines of growth crossed by indistinct radiating lines, which are not perceptible on the umbo, beak turned toward the carinated side ; the muscular impression of this side is oval and less distintinct; an elevated radiating line passes along its side; margin entire.

*Locality.*—Claiborne, Ala.

Cossmann seems to have gotten some specimens of this very rare species in his barrelful of Claiborne sand, and has somewhat rectified Meyer's description, based solely on one worn specimen. He very properly compares it with *media* of the Paris Basin, to which it is closely allied.

The gibbose, small specimens figured by de Gregorio, pl. 23, figs. 15-19 of his work and referred to as "*delivis*" are certainly not that species as its young are rather flattish, as will be seen by referring to pl. 19, of this work. They would fit in much better with *ledoides*, perhaps Conrad's *corbuloides*.

This species when well preserved in the Claiborne sands shows traces of very fine radiating sculpture, of a much more even type than in *pulchra* or its mutations. Specimens from the Orangeburg district are with practically no trace of radiate sculpture. The species is very gibbose and corbuloid. This leads us to wonder if perhaps Conrad's very elusive "*Limopsis corbuloides*" may not be this same species. A former note made at the Phila. Academy is to the effect that in a tray in the Conradian collection there are two original labels, one "*Limopsis declivis*" and the other "*Limopsis corbuloides*". Of the seven specimens, six are of the St. Maurice stage *declivis*, "one however, smaller, more inflated and cuneiform, doubtfully of the same species" At the present writing we are unable to say whether this smaller specimen is the young of *decisa* or an adult *ledoides*. Conrad's original description (of *corbuloides*) reads: "Subtriangular, with one side cuneate and angulated on the submargin; beaks centrals, cavity capacious, margin entire." No one seems to have re-identified Conrad's species. Even he, while clearing up the "*Limopses*" in the Jr. Phila. Acad., IV, 1860, p. 297, omits a figure of *corbuloides*, though he carries it along in his list of '65, Am. Jr. Conch., vol. 1.

*Type.*— Aldrich Coll. J. H. Univ. Coll.

*Horizon.*—St. Maurice Eocene.

*Specimen figures.*—C. U. Pal. Mus., from Claiborne.

*Localities.*—Claiborne Ala.; 3 and 6 miles W. N. W. of Orangeburg, S. C.

**Trinacria pulchra** Gabb, Pl. 18. Figs. 11-14.

*Nœtia pulchra* Gabb, Jr. Phila. Acad. Nat. Sci., IV, 1860, p. 388, pl. 67, fig. 55.
*Limopsis pulcher* Heilp., Proc. Acad. &c., 1890, p. 403.
Same as *Trinacrina dicisa*, *fide* Dall, Trans. Wag. III, '65, p. 658.
Same as *Limopsis decisus ?*, *fide* Con., J. A. Conch., vol. 1, 1865, p. 12.
For Gabb's original description, see these Bulletins, vol. 2, p. 240.

We note that Dall calls attention to Sowerby's *Arca pulchra*, dating from 1824, but on no occasion do we find Gabb using *Noëtia* with *pulchra* except as an independent genus. The name, also, is very appropriate. As to its relationship to *decisa* one notes at once its smaller and much more inflated form and comparatively thicker shell and stronger radial markings. It is very characteristic of the St. Maurice stage W. of the Mississippi.

The sculpturing varies from rather pronounced radiating raised lines (appearing most pronounced between the growth lines) to those less conspicuous, but broader, separated by sharply depressed lines of growth. Gabb's sketch of this species as shown in the Jr. Phil. Acad., above referred to is not bad, showng as it does the true form, size and the characteristic ligamental area of the genus.

*Type.*—Phila. Acad. Nat. Sci.

*Horizon.*—St. Maurice Stage of the Eocene.

*Specimen figured.*—Paleont. Mus. Cornell Univ.

*Localities.*—*Texas:* Colorado River, Devil's Eye, Bastrop Co.: Smithville, Bastrop Co.; Wheelock, Robertson Co.; Cedar Cr., Robertson Co.; Little Brazos River, near Mosley's Ferry road; Well at College Sta., Brazos Co.; Alabama Bluff, Trinity River; Campbell Cr., Gifford Headright, Robertson Co.; Berryman place, Kimble headright, Cherokee Co.; Orrell's Crossing, Elm Cr., Lee Co.; one mile south from Nevilles, Gonzales Co.; three miles south of Palestine, Anderson Co.; Anderson's Ranch, Frio. Co. *Louisiaua:* Chautauqua; deep water well at the Brewery, Monroe. *South Carolina :* Orangeburg District.

Var. **sabinica** n. var. Pl. 18. Figs. 15, 16.

On the Sabine River, particularly near the township line between 4 and 5 north, though on the Texas side, there is a marked form of *pulchra*, much more carinate and cuneiform and of much smaller dimensions than typical specimens. In fact, in outline it closely approaches *ledoides* of Meyer. But, as will be seen by the illustrations it is really not at all closely related to that species.

**Trinacria decisa** Conrad, var. Pl. 18. Figs. 17-19.
Pl. 19. Figs. 1, 2.

*Pectunculus decisus* Con, Foss. Shells &c., 1833, p. 39.
*Limopsis decisus* Con., Jr. Phila. Acad. Nat. Sci., vol. IV, 1860, p. 297-8, pl. 47, fig. 16.
Probably *Trinacria decisa* Cossmann, Notes Compl., '93, p. 16, figs. 17, 18.

*Conrad's original description.*—Shell longitudinally suboval, equilateral, with obsolete radiating striæ ; posterior end obliquely truncated, umbonial slope angulated, incurved ; beaks small, pointed and recurved ; cardinal teeth small and crowded ; series not much arcuated ; margin entire. Length ½ an inch.

We have no specimens from the Claiborne "sands" that could be referred to this species. However, Cossman has illustrated a small, seemingly rather flat specimen with fine radiating lines clearly referable to a variety of *decisa*. In the Orangeburg District, S. C. we have several much larger specimens of the same general type, one to which we have given the name *carolina* (fig. 18, a). With it, however, are forms becoming much shorter proportionally, and deeper, and having the umbones more deflected posteriorly, these we styled var. *abbreviata* (fig. 19). They show by their general configuration and faint, broad ribs (often bifurcate) that they are very closely akin to the specimens of this species occurring rather sparingly with *declivis* at the base of Claiborne Bluff and at Lisbon (see illustrations, pl. 18).

*Horizon and localities.—St. Maurice :* Base of bluff at Claiborne and Lisbon, Ala. ; Cedar Cr., Wheelock league ; Colorado River at Smithville ; Trinity River at Alabama Bluff ; Brazos

River, 500 yards below the mouth of Little Brazos, Tex. Hammett's Branch, Sabine River ; Ruston Well, La.

Var. *carolina.*—Three miles and six miles W. N. W. of Orangeburg, S. C.

Var. *abbreviata.*—Six miles W. N. W. of Orangeburg, S. C.

**Trinacria declivis** Conrad, Pl. 19. Figs. 3-6.

*Pectunculus declivis* Con., Foss. Sh. Tert. Form., 1833, p. 39.
*Limopsis declivis* Con., Jr. Phila. Acad. Nat. Sci., vol. 4, 1860, p. 297, pl. 47, fig. 13.
*Limopsis declivis* de Greg., Faun. Eoc. de l' Ala., 1890, p, 191, pl. 23, figs. 21-24.
*Trigonoarca declivis* Dall, Trans. Wag. &c., III, '95, p. 606.

*Conrad's original description.*—Shell ovate acute, rather compressed, with fine concentric crowded lines, and very minute and obscure radiating lines, which become very distinct on the posterior side, near the extremity ; posterior side cuneiform ; beaks small, pointed and recurved ; series of cardinal teeth interrupted under the beaks ; margin entire. Length ¾ of an inch.

The posterior basal margin is drawn out characteristically only in adult forms, the young are nearly quadrate (pl. 19, fig. 5). The exterior markings on this shell are very characteristic. Radii are clearly defined on the posterior portion, but die away anteriorly where concentric lines become more prominent, certain of the latter still show a trace of the radiate ornamentation in the form of concentric, microscopic beading.

This is the abundant and well preserved species of this genus found near the water's edge in the blue clays just above the "Upper Landing" at Claiborne,—the *Cardita densata* bed of Conrad. Common also at Lisbon, a few miles higher up the Alabama river.

*Types.*—Phila. Acad. Mus.

*Specimens figured.*—Paleont. Coll. Cornell Univ.

**Trinacria pectuncularis** Lea, Pl. 19. Figs. 7-8.

*Nucula pectuncularis* Lea, Cont. to Geol., 1833, p. 81, pl. 3, fig. 60.
*Limopsis pectuncularis* Con., Jr. Am. Conch., vol. 1, '65, p. 12.
*Trinacria pectuncularis* Dall, Trans. Wag. &c., III, '95, p. 577.

*Lea's original description.*—Shell trapezoidal, compressed, nearly equilateral, angular before, rounded behind, flattened on the sides, straight at basal margin, longitudinally and minutely ribbed ; anterior slope large, carinate ; substance of the shell thin ; beaks recurved, pointed ; both series of teeth small and nearly equal, the posterior one rather the smaller; fosset on the plate and immediately under the beak, oblique; cavity of the shell shallow; margin entire; nacre apparently not pearly.

'Diam. . . Length .1, Breadth 3-20ths of an inch.

A single valve only of this truly interesting little Nucula has been obtained by me. It differs in outline from any species I am acquainted with, its trapezoidal form being very peculiar. At first sight, upon examination of the teeth, I took it to be a *Pectunculus*, but a further examination with the microscope showed me the fosset for the ligament, between the two series of teeth. It has a distinct fosset, but unlike the genus generally in this, it is placed above the teeth, and directly at the point of the beak. We may with great propriety, consider this to be the connecting link with the *Pectunculi*, the "nuance" being into that of the *P. ellipsis* (nob). A more complete junction could scarcely be established.

This is a well-defined but very rare species. Neither Gregorior nor Cossman seemed to have obtained specimens of it. Dall's remark that it should be referred to *Trinacria* seem to indicate that he had specimens before him in 1895.

The sinuosity of the posterior margin is generally well-defined, likewise a basal emargination. Fig. 8, however, is quite regular in outline.

*Type.*—Probably one of the three specimens found glued on the some card and labelled *Nucula pectuncularis*, catalogued by the writer as 5404 of the Acad. Record. Lea says he had but "a single valve."

*Locality and horizon.*—Claiborne "sand" at Claiborne, Ala.

**Trinacria ovalis**, n. sp., Pl. 19. Fig. 9 a.

*Specific characterization.*—Form and size as figured; substance of shell rather thin; somewhat inflated centrally; main shell surface and post-umbonal slope not sharply differentiated; posterior margin rounded, non-truncate and not pointed basally; radiate ornamentation fine and weak.

From the St. Maurice formation as the base of the Claiborne bluff, above the Upper Landing, just below the Ferry.

*Type.*—Paleont. Mus., Cornell Univ.

**Trinacria perplana** Conrad, Pl. 19. Figs. 10, 11.

*Pectunculus perplanus* Con., Jr. Phila. Acad. Nat. Sci., 1st ser., vol. 7, 1834, p. 134. (Not in Foss. Sh. &c., p. 40. as stated by Conrad in

A. J. Conch, vol. 1, p. 12; nor is it shown as fig. 16, pl. 47, in Jr. Phila. Acad., vol, 4, 2d ser. as Conrad states.
*Trigonarca perplana* Dall, Trans. Wag., &c., III. 1895, p. 606.

*Conrad's original description.*—Shell suboval, much compressed: with radiating striæ; anterior and posterior margins wide and obtusely rounded or subtruncated; beaks central not prominent; series of cardinal teeth interrupted by an oblique fosset; margin entire. Length more than half an inch.

*Locality.*—Claiborne, Ala.

Three specimens, presumably the types are in the Conradian collection of the Phila. Academy.

This resembles in some respects a great over-grown *ellipsis* but it is quite probably a distinct species. It is very rare, neither de Gregorio nor Cossmann found a single specimen in their respective materials from Claiborne Bluff. The latter, however, shows an entirely different form for *Limopsis perplanus* (figures 20-21, pl. 1) which Dall very properly renames *cossmanni.*

This is the giant *Trinacria* from the Claiborne sands and approaches in dimensions the *declivis* from the St. Maurice horizon below.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

**Trinacria ellipsis** Lea, Pl. 19. Figs. 12-17.

*Pectuculus ellipsis* Lea, Cont. to Geol., Dec., 1833, p. 78, pl. 3, fig. 56.
*Limopsis ellipsis* Con., Jr. Phil. Acad. Nat. Sci., IV, 1860, pl. 47, fig. 9. (Named on p. 297.)
*Trigonarca ellipsis* Dall, Trans. Wag. &c., III, 1885, p. 606.

*Lea's original description.*—Shell transversely elliptical, compressed, inequilateral, concentrically and minutely striate, with small longitudinal rugose ribs, more strongly marked on the posterior and anterior parts; beaks rather elevated, recurved; hinge teeth very small, numerous and scarcely interrupted in the middle; cicatrices impressed; cavity of the shell shallow; margin entire.

Diam . .2, Length 7-20ths, Breadth 9-20ths of an inch.

"*Observation.*—In some of its characters the *ellipsis* closely resembles the *minor*, but is eminently distinguished by the absence of *marginal* crenulations. It is more transverse and has smaller dorsal teeth. Immediately under the beak is a fosset-like impression, which may have been the seat of the ligament. In this it has some resemblance to the *nucula;* but is placed above the row of arched teeth."

De Gregorio seems to have had trouble in identifying any of his material with this species; in fact it would appear that no specimens of it were contained in his collection. It is by no means rare at Claiborne. It shows a wide range in size and form as our figures will attest. The earlier stages of growth in *perplana* appear much like this species; but as this appears rarely if ever to surpass the size indicated for it by Lea, *perplana* may well be regarded as a different species.

This is by all odds the most common species of this genus found in the Claiborne sand bed. Its nearly circular form, thickness of shell for its size and lack of umbonal carination distinguish it at once from most other forms.

A thicker, heavier, more rugged and slightly more circular variety of this species is found at Lisbon, Ala., and may be distinguished as var. *lisbonensis* (figs. 16, 17).

*Type.*—Phila. Acad. Coll.; presumably No. 5357.

*Horizons and localities.—St. Maurice:* Ruston well, 1200 ft. level, La.; Lisbon, Ala. *Claiborne:* Claiborne Sands, Ala.; 6 miles W. N. W. of Orangeburg, S. C.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

**Trinacria cossmanni** Dall, Pl. 20. Figs. 1, 2.

*Limopsis perplana* Cossmann, Notes Compl. &c., 1893, p. 16, pl. 1, figs. 20-21.
*Limopsis cossmanni* Dall, Trans. Wag. &c., III, '95, p. 605.

This regularly formed little species is not *perplana*, as Dall has pointed out, but its relationship to the latter is not very distant. For were it not for the somewhat stronger dentition in *ellipsis* (or even the young of *perplana*) it would be very difficult to separate forms of these species that happen to have about the same outline. In fact we have been at first in doubt as to whether certain specimens should be placed with *cossmanni* or *ellipsis*. Typical *cossmanni* represents the limiting species of this genus as far as bilateral symmetry is concerned. We do not place it with *Limopsis*, although with the general straightness of beak there is a tendency to show some ligamental area behind the beak. On examining several specimens it becomes apparent that the fosset is of the *Trinacria* type, with more area before the beak than behind it, and with vertical, *Noëtia*-like grooving of the bottom. The pit in *Limopsis* is on the order of the cartilage pit in *Pecten*, showing, at least in good specimens a horizontal sculpturing on the bottom. There is no "hinge area" as in typical *Limopsis*.

All our specimens so far as known have come from the Claiborne sands at Claiborne, Ala.

The specimens figured were collected by the writer on various occasions at the "Bluff" and are in the Museum (Paleontological) of Cornell University.

**Trinacria (Pachecoa) cainei**, n. s. gen. and n. sp., Pl. 20. Fig. 3, a.

Definition of *Pachecoa*.—Shell small, rather thin, and of the general appearance of *Trinacria ovalis*, but differing widely from all other species of the genus by having an *Arca*-like exterior ribbing.

*Specific characterization.*—Form, size and appearance as shown by the illustrations and explanations ; ribs about 26-28 on the face of the valve, lacking on post-umbonal slope ; lower margin strongly crenulated by the extremities of ribbing ; ribs having a tendency to become divided by median line and even bifurcate toward the umbonal slope or posterio-basal margin.

*Type and specimen figured.*—Paleont. Mus. Cornell Univ.

*Localities.*—Three miles and six miles W. N. W. of Orangeburg, S. C. Collected by two of our former students, Caine and Pacheco, 1899.

**Glycymeris stamina** Conrad. Pl, 20. Figs. 4-8.

*Pectunculus stamineus* Con., A. J. Sci., 1833, (Jan.), vol. 23, p. 342.
*P. Broderipii* Lea, Cont. to Geol., Dec. 1883, p. 76, pl. 3, fig. 53.
*Axinæa stamina* Con., A. J. Conch., vol. 1, '65, p. 12.
*Pectunculus Broderipii* de Greg., Mon. Faun. Ala., '90, p. 193, pl. 24 figs. 2-14.

*Conrad's original description.*—Shell suborbicular, ventricose ; with distinct radiating and finer intermediate lines, crossed by minute crowded striæ ; inner margin serrate. Length one inch and a half. Found with the preceding [at Claiborne.]

As regards the ribbing of this species, it should be noted that while the individual is less than one-half inch in diameter the ribs seem narrow, raised, more or less unevenly spaced and of less width than the interspaces. The crossing of the concentric lines causes a slight beading effect on very well preserved, very small specimens. Later on, the ribs appear to widen and often bifurcate and occupy the greater part of the shell surface. By holding the shell in a strong side light it appears that one margin of each rib is slightly higher than the other, so that a horizontal section through, for example, the center of the shell, would show the ribs slightly saw-tooth shaped. For the greater part of the shell, the gentler slope is on the anterior side of the rib, but anterior to a line drawn from the beak to the anterior-basal margin this condition of affairs is reversed, i. e. the gentler slope on such anterior ribs is on the posterior side.

This species, so far as our collections go, seems to be confined to the Claiborne stage of the Eocene.

*Type.*—Phila. Acad. Coll.

*Specimens figured.*—Deposited in Paleont. Mus. Cornell Univ.

*Horizon.*—Claiborne Eocene.

*Locality.*—Claiborne Bluff, Ala.

**Glycymeris idonea** Conrad, Pl. 20. Figs. 9-11.

For synonymy, and Conrad's original description, see Bull. Am. Pal., II. p. 241. Also note :

*Axinea idonea* Con., A. J. Conch, I, '65, p. 12.

*Pectunculus Broderipii* var. *radiatus* de Greg., Mon. Faun. Eoc. de l' Ala., '90, p. 194, pl. 2, figs. 15, 16, (not 7-12, &c.).

*Glycymeris idoneus* Dall, Trans. Wag. &c, vol. III, '95, p. 607.

*Pectunculus idoneus* Har., Bull. Am. Pal., I, '95, p. 22.

Conrad's original description already referred to is fair ; but without a figure, or access to type specimens, one naturally feels some uncertainty about this species as the writings of de Gregorio and Cossmann attest. The species however, need never be confounded with *staminea* on account of its greater obliquity, thicker shell and comparatively greater depth. The markings on the young of this species consist of a large number of radiating lines crossed and crenulated by fine conceneric lines (compare figs. 6 and 11). As the shell grows older, there is a slight tendency for the radiating lines to group themselves in broad, faint ribs, but in the adult stage the exterior of the shell lacks the moderate ribbing of *staminea* and appears very nearly smooth. Different weathering and stages of decortication bring out different faint radiating features, —fine lines especially. The internal crenulations of the margin, however, show about 60 crenulæ in place of about 80 in like sized specimens of *staminea*.

This species is perhaps one tenth part as abundant in the Claiborne sands as *staminea*. But, strangely enough, as one leaves that locality or descends into lower stages it is clearly the *idonea* stock that prevails. As already stated in these Bulletins, (11, p. 242) it is very doubtful whether the specific name *idonea* ought to be used for the Lignitic or Sabine forms; as it will be seen by consulting pl. 14, figs. 5 and 6, that they are too erect, and show ribbing far too distinctly. The early Eocene forms recorded in the Maryland State Survey publications, (Eocene, pl. 51,) are a little more oblique than the early Gulf representatives, but still show the Sabine stage ribbing. On the other hand, the vast numbers of representatives from the Orangeburg District, S. C., seem no better ornamented exteriorly than the Claiborne sand forms and are even more pointed or angular in appearance. There seems to be no reason why the latter may not be referred to a mutation of *idonea*.

*Type.*—Phila. Acad. Mus.

*Horizons.*—Sabine ?, St. Maurice and Claiborne Eocene.

*Localities.*—Claiborne, Ala.; Orangeburg District, S. C.; Centre Hill, ? S. C.

**Glycymeris lisbonensis**, n. sp., Pl. 20. Figs. 12-15.

General form, size and characteristics as shown by the figures. A thinner, more nearly circular shell than either *staminea* or *idonea*, with more sharply pointed beak; and, possessing when young comparatively strong concentric lines, while the radiating lines if present are confined to the margins (see fig. 13). There is an early, *Limopsis*-like, stage, generally separated off from the adult stage by a sharply incised growth line. General appearance of the adult ribbing is similar to that of the Sabine species usually referred to *idonea*.

*Types* and *specimens figured.*—Paleont. Coll. Cornell Univ.

*Horizon.*—St Maurice Eocene.

*Localities.*—Lisbon, Ala.; Wautubbee, Miss.

**Glycymeris trigonella** Conrad, Pl. 26. Figs. 1,7.

*Pectunculus trigonella* Con., A. J. Sci., vol. 23, 1833, p. 342.
*Pectuculus deltoideus* Lea, Cont. to Geol., Dec., 1833, p. 77, pl. 3, fig. 55.
*Axinea trigonella* Con., A. J. Conch, vol. 1, 1865, p. 12.
*Pectunculus deltoidus* de Greg., Mon. Faun. Eoc., Ala., 1890, p. 194, pl. 23, figs. 15, 16, 32, 38, 42; pl. 24, figs. 1, 2, 3.
*Pectunculus trigonellus* Har. These Bulletins, vol. 1, 1895, p. 46.
*Glycymeris trigonella* Dall, Trans. Wag. &c., III, 1895, p. 606.

*Conrad's original description.*—Shell subtriangular, elevated, with radiating striæ; anterior margin nearly rectilinear and subangular at the extremity; inner margin serrate. Length, half an inch.

*Locality.*—Claiborne, Ala. London clay.

This is a very abundant shell in the Claiborne sands and one which seems to be in that same plastic state shown by species of *Venericardia* in the Midway. Full-grown specimens average about 10 mm in greatest diameter, but some may attain a height of 14 mm. Some are very cuneiform, others nearly circular; some with sharply defined ribs, some with faint ribs or none at all; some with coarse marginal crenulation, often coarsest medially, some with much finer crenulation.

The more circular forms, with finer marginal crenulation received the specific name of *minor* from Lea (figs. 6, 7). Such forms are usually nearly smooth exteriorly, as Lea's type in the Phila. Acad. Collection is. (Ribbing must have been put in from another specimen by the artist. See Lea's fig. 54.)

Most Claiborne specimens are considerably worn and the ribbing is somewhat obscured. Naturally the more faintly ribbed specimens would appear more nearly smooth and these may be thought of as constituting a variety *minor*. Yet in some cases the exterior of the shell seems never to have been ribbed at all, and to such specimens de Gregorio has given the varietal name *ignus*. Some well-preserved specimens show clear-cut ribs and are termed "var. *striatus*" by de Gregorio. The most cuneate forms he styles "var. *percuneatus*".

This author well remarks: "These four forms pass from one to the other, in such a way that it is difficult to determine them when one has before him a large number of samples. Nevertheless I have deemed it advantageous to make them known, for in a hasty examination, one might take them to be different species (p. 195. Mon. Faun. Eoc. Ala).

Well preserved specimens, generally young, show in the early stages of growth a fine, crowded, slightly irregular concentric sculpturing. The ribs are most pronounced generally anteriorly, but are very variable in size and strength in different individuals; slightly bent backwards medially; with anterior margins higher than the posterior and retaining this feature to the very anterior margin of the shell.

Judging from the specimens before me it would appear that the more circular forms, with but slight radiating sculpture, the *minor* type of Lea, is the older and the more prevalent in the St. Maurice stage. Some specimens from Hammett's Branch show some variation, but all are very small. Those from the Ruston well (400 ft.) are more nearly normal *minor*. The species is rare in Louisiana, known to me from Texas, by one small, eroded valve, and occurs at Wautubbee, Miss., var. *wautubbeana*, n. var., in a thick, small, heavy form with so far as observed no fine umbonal concentric sculpturing, but with heavier lines of growth extending over more of the surface of the shell, recalling to mind the surface features of *Glycymeris lisbonensis* while very small, though without the anterior and posterior radii. Very small specimens of this variety occurs at the 1200 ft. level in the Ruston Well.

*Type.*—Phila. Acad. Coll.

*Horizons.*—St. Maurice and Claiborne Stages.

*Specimen figures.*—C. U. Pal. Mus.

*Localities.*—Hurricane Bayou, Houston Co., Tex. (one valve only), Tex. St. Mus.; Hammett's Branch; Ruston well, La., both from 400 and 1200 ft.; Wautubbee, Miss. (var); Claiborne stage,—Ferruginous sands at Claiborne, Ala.

Vaughan cites this species from various localities in the McBean formation in Georgia.

**Glycymeris sabinensis**, n. sp., Pl. 21. Figs. 8-10

*Characterization.*—Shell small, *Glycymeris*-like in general, but with deltoid ligamental area unusually deep and very limited laterally for adult specimens, flanked on either side by a pronounced cardinal area, features creating, at first sight, a *Limopsis*-like aspect; exterior ornamented by numerous well-marked, broadly rounded ribs over which the fimbriate growth lines sweep in exquisite beauty and regularity.

Twenty-five years ago, in a MS report, pl. 7, fig. 8, on the Tertiary Mollusca of Texas I illustrated this species, but having only one shell, I refrained from naming it, thinking perhaps it should be referred to the young of some form not then known to me. However, Mr. A. C. Veatch, while assisting on the Louisiana Survey, found a large amount of interesting fossils along the Sabine River during his solitary canoe trip in 1900. In working over this material recently a goodly number of specimens of this species was found in with *Limopsis aviculoides.* They are from the Texas side of the Sabine about on the Tp. line between 4 and 5 N., La. land survey. Hence they are of St. Maurice Eocene age.

*Types.*—Deposited in the Paleont. Mus. Cornell Univ.

*Localities.*—Elm Cr., Lee Co.; Sabine River as above stated.

**Arca rhomboidella** Lea, Pl. 21. Figs. 12-17. Pl. 22. Figs. 1-3.

*A. rhomboidella* Lea, Cont. to Geol., 1833, p. 74, pl. 2, fig. 52.
*Anomalocardia rhomboidella* Con., Jr. Am. Conch., vol. 1, 1865, p. 11.
*Arca* (*Cucullæarca*) *cuculloides* de Greg., non Con., Mon. Faun. Eoc. Ala., 1890, p. 195, pl. 24, figs. 17-20.
*Arca rhomboidella* Coss. (in part), Notes Compl. 1893, p. 17.
*Arca* (*Scapharca*) *rhomboidella* Dall, Trans. Wag. &c., III, '95, p. 625.
*Arca rhomboidella* Sheldon, Paleont. Amer., vol. 1, 1916, p. 30, pl. VII, 6-10.

*Lea's original description.*—Shell rhomboidal, very inequilateral, compressed at base, longitudinally and closely ribbed; substance of the shell thin; beaks small, pointed; ribs about thirty-three, obsoletely tuberculated on the anterior portion; teeth lamellar, oblique; cicatrices scarcely perceptible; cavity of the shell rather shallow, margin crenulate.

Diam. . . Length .2, Breadth 7-20ths of an inch.

This seems to be a rather characteristic species of the mid-Eocene of the more central Gulf States. As is well known it was first figured by Lea from a very young specimen, yet entirely recognizable. Dall has straightened out the erroneous references of this species to *cuculloides* and the excellent illustrations of Sheldon have given the final touches in the matter.

This species shows considerable variation in accordance with horizon and locality. A few of the more common forms may here be mentioned.

At Claiborne (sand-bed) the average adult is about 20 mm in length, though some specimens may reach 35 mm. In the specimens from the base of the bluff and at Lisbon, 30-35 mm is a common limit; but in the Orangeburg District, S. C. some specimens reach 45 mm. Small and rare specimens only are known from Texas (see var. *parsaba* along the Sabine).

Claiborne sand specimens vary among themselves considerably so that, while in the main Lea's description holds true, there is apt to be a rather noticeable gibbosity in the centro-anterior portion of the shell. The medial portion of the shell is more finely ribbed than the extremities. This comes about somewhat by bifurcation of the ribs but mainly by implantation The anterior ribs are generally more or less grooved, likewise the sub-ligamental ones. The heavy ribs on the umbonal ridge are the last to be subdivided or even channelled, practically never so in "sand bed" shells. The number of primal ribs is in the neighborhood of thirty. In the St. Maurice beds below (at base of Claiborne Bluff and at Lisbon, var. *subscopula*, n. var.) the primal ribbing shows a greater number, about 40, the subdivision (by bifurcation) is quite evenly carried out over the surface of the shell. The posterior basal margin is apt to be more acute, the anterio-basal margin more obtuse. The Orangeburg District specimens are again practically of the Claiborne type, though larger and showing a tendency to have grooves on the distal portions of the big umbonal costæ.

Senile forms become edentulous save at either extremity of the hinge.

*Types*—Phila. Acad. Nat. Sci., No. 5306.

*Specimens figured.*—Paleont. Mus. Cornell Univ.; Ald. Coll., Johns Hopkins Univ.

*Localities.*—Texas : Lee Co. ; Louisiana : St Maurice ; ½ mile S. of Winona ; Hammett's Branch ; 3 miles S. E. of Negreet ; Mississippi : Newton ; Wautubbee (Aldr.). Ala. : Claiborne sands ; base of Claiborne bluff, Lisbon.

**Arca vaughani** Casey, Pl. 22. Figs. 5, 6, 7.

*Arca rhomboidella* var. Vaughan, U. S. G. S., 142; pl. 3, fig. 8, 1896.
*A. vaughani* Casey, Proc. Acad. Nat. Sci. 1903, p. 265.
*A. vaughani* Sheldon, Palæontogr. Amer., vol. 1, 1916, p. 31, pl. 7, figs. 11.

*Casey's description.*—A species quite common in the Lower Claiborne at St. Maurice, La., and allied somewhat to *rhomboidella* Lea. It attains a length of more than 22 mm with a height of 12 mm or more, obliquely rhomboidal, moderately inequilateral, rounded anteriorly and posteriorly and broadly rounded ventrally. It is moderately inflated, the radiating concavity at the middle of the umbones almost obsolete and having merely slightly wider intervals between the ribs, the latter 41-43 in number. The hingeline is long and straight, the teeth becoming larger and very oblique laterally but well developed throughout, with their sides finely ribbed, giving to each tooth a bipectinate appearance. The area under the beak is ample and broadly divaricately striate. This species differs from *rhomboidella* in its much larger size, more numerous ribs, rounded ventral edge and many other characters, and may be named *vaughani*. A fair illustration of it was given by Mr. Vaughan (Bull. Geol. Surv. 142, Pl. III, fig. 8), in whose honor it is named. A modification of the true *rhomboidella*, but still smaller in size, also occurs sparingly at St. Maurice.

Dr. Sheldon has already corrected the misconception as regards comparative size of the species mentioned.

This is seemingly a direct off-shoot from *rhomboidella* with a more arcuate ventral margin, more even ribbing, more oblique form and comparatively thicker shell substance. There are intermediate forms, however, very difficult of classification.

*Type.*—U. S. Nat. Museum?

*Specimens figured.*—Paleont. Mus., Cornell Univ.

*Localities.*—St. Maurice, La. and Sabine River, Texas side.

**Arca (cucullo̲ides?)** var. **ludoviciana** n. var. Pl. 22. Figs. 8-16.

Conrad described *cucullo̲ides* in his Foss. Shells Tert. Format., 1833, p. 37; and we have repeated the description in vol. 2 of these Bulletins, p. 239. Dr. Sheldon has recently discussed the species in the first number of *Palæontographica Americana.* We here give, for the first time, a figure of what appears to be Conrad's type of the species in the Collection of the Phila delphia Academy (Pl. 22, fig. 17). This slightly deformed specimen quite likely belongs to the same species as the Jacksonian *lima* as Sheldon maintains. Conrad's specimen from "Claiborne, Ala." might well have fallen down from some Jackson horizon above the Claiborne "sands". We have in our various collections from the latter horizon at Claiborne never found any specimens of this shell.

Our new variety *ludoviciana* does not have the ribbing on the different parts of the shell perhaps quite so markedly differentiated as in typical *cucullo̲ides* nor is there the umbonal carination so depended upon by Sheldon for identification of the species. Yet there is a tendency to the same type or ribbing and in a few small specimens (see fig. 11) the post-umbonal slope is sharply differentiated from the remainder of the shell. This early form seems to have some features in common with both *cucullo̲ides* and *mississippiensis.*

*Types.*—Deposited in Paleont. Mus. Cornell Univ.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—In C. U. Mus., from Sabine R.

*Localities.*—Smithville, 2 miles E. of Alto, San Antonio F'y, Alabama Bluff, Campbell Cr., etc., Texas; Sabine River, Vivian, Roberta, Winnfield Marble Q'y, Atlanta well, La.; base of bluff, Claiborne, Ala. Obscure impressions near Grovetown, Ga., seem to belong here. The distribution of this variety is much more to the west than was the case with *rhomboidella* and its close relatives.

**Arca (Acar) reticulata** Gmelin, Pl. 22. Figs. 18, 19

*Arca reticulata* Gmelin, Syst. Nat., VI, 1792, p. 3311.
*Barbatia* (*Acar*) *reticulata* Dall, Trans. Wag. III, '98, p. 629.

*Gmelin's original description.*—A. testa subrhomboidea decussatim striata alba: natibus approximatis, vulva cordata.
List. Conch., t. 233, f. 67.
Martini Besch. Berl. Naturf. 3, t. 6, f. 9.
Chemn. Conch. 7, t. 54, fig. 540.

Dall, *loc. cit.* includes a number of recent and Tertiary *Acar* forms in this species. He remarks: "The fossils are identical with the recent shells in every particular, and there can be no doubt that this species has existed continuously in the Antillean region since the Upper Eocene." Doubtless the Upper Eocene forms he refers to, from Jackson, Miss., are small *Arca aspera* of Conrad, though in his synonymy of that species Dall places it under *cucculloides*. If the Jackson *aspera* is included in *reticulata*, there seems to be no reason why this St. Maurice form should not be likewise included.

*Horizon.*—Mid-Eocene to Recent.

*Specimens figured.*—Paleont. Coll. Cornell Univ.

*St. Maurice localities.*—Wautubbee and Hickory, Miss.; Smithville, Tex.

**Arca aldrichi** Dall, Pl. 22. Fig. 20.

*Barbatia* (*Cucullaria*) *aldrichi* Dall, Trans. Wag., III, 1895, p. 630. pl. 32, fig. 19.
*Arca aldrichi* Sheldon, Palæontogr. Amer., vol. 1, 1916, p. 23, pl. 5, fig. 5.

*Dall's original description.*—Shell small, elongate, thin, somewhat pointed behind, rounded in front, moderately convex, with low, prosogyrate beaks; cardinal area very narrow and elongated, widest in front of the beak; surface evenly sculptured by fine equal, flattish radial riblets, separated by narrower grooves and crossed by irregularly spaced impressed lines; inner margin of the valves smooth or slightly fluted in harmony with the ribs, especially behind; beaks in the anterior forth; hinge line about two-thirds the length of the shell; hinge anteriorly with four oblique, rather close-set teeth, separated by a wide gap from the posterior teeth, which are about six in number, smaller proximally, and parallel with the hinge line. Lon. 8.3. alt. 5, diam. 4 mm.

This single valve is all that is known of this species; it came from the Claiborne "sand" and is in the National Museum. The figure given is from Dall (*op. cit.*).

**Arca harrisi** Sheldon, Pl. 22. Fig. 21.

*Arca inornata* Meyer, Bull. 1, Geol. Surv. Ala., 1886, pt. II, p. 79, fig. 24.
*Arca harrisi* Sheldon, Palæontogr. Amer., vol. 1, 1916, p. 21.

*Meyer's original description.*—Trapezoidal; anterior side truncated, flat; beak small; ligament area very low; teeth smallest toward the middle; covered with indistinct concentric lines; margin entire. Locality, Claiborne, Ala. Resembles *Arca lævigata* Caillat (Desh. An. sans vertèb., I, p. 905, pl. 68, figs. 23-26) from the Paris Basin but is less oblong.

So far as we are aware no one since Meyer's time has found another specimen of this peculiar form. Its generic assignment seems open to doubt. The specific name was changed by Sheldon because Meek and Hayden had described an *Arca* (*Cucullæa*) *inornata* in 1858 (Proc. Phila. Acad., p. 51).

We have herewith copied Meyer's figure. The type is doubtless in the Aldrich collection at Johns Hopkins Univ.

**Leda semen** Lea, Pl. 23. Figs. 1-4.

*Nucula semen* Lea, Cont. to Geol., 1833, p. 200, pl. 6, fig. 214.
*Nuculana semen* Con., Am. Jr. Conch., vol. 1, '65, p. 13..
? *Nucula micronata* Con., Proc. Phila. Acad. Nat. Sci., vol. 4, 1847, p. 297; Jr. Phila. Acad., vol. 1, 1849, p. 128, pl. 14.
*Nuculana semen* Cossm., Notes Compl. 1893, p. 15.
*Nuculana semen* Ald., Bull. 1, Gəol. Surv. Ala., '86, p, 49.
*Leda semen* Dall, Trans. Wag. &c., '98, p. 578.

*Lea's original description.*—Shell transversely elliptical, rather inflated, furnished with large concentric folds, and with a deep furrow on the anterior slope, rostrate behind; substance of the shell rather thin; lunule and escutcheon both lanceolate; beaks small, rather pointed; margin entire; nacre not pearly.

Lea had but one immature specimen and that is now lost. However, there is no danger of incorrect identification when dealing with this species. See the illustrations.

*Type.*—Was from Claiborne sands, but is lost.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Localities and horizons.*—*St. Maurice:* Lisbon, Hamilton Bluff, Ala.; Piping Tree, Va.; 3 and 6 miles W. N. W. of Orangeburg, S. C. *Claiborne:* Claiborne sands.

**Leda semenoides** Aldrich, Pl. 23. Figs. 5, 6.

*Leda semenoides*, Aldr., Bull. Amer. Pal., vol. 1, 1895, p. 70. pl. 6, fig. 5.

For the original description, see the above reference. Both description and illustration were drawn from a very immature specimen. Though this species is not rostrate in the same manner posteriorly as *semen*, (i. e. the upper, posterior radiating fold alone projecting far out from the general margin of the shell) the two, radiating, posterior, crenulated folds form something of a beak as the figure of a cast clearly shows. The adult shell reaches a length of 17 mm. at least.

*Type.*– Aldrich Coll. J. H. Univ. Coll.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Localities.*—Lisbon, Hamilton Bluff, Ala.; Ft. Gaines, Ga.

**Leda cœlata** Conrad, Pl. 23. Figs. 7, 8, 9.

*Nucula cœlata* Con., Am. Jr. Sci., vol. 33, Jan. 1833, p. 343.
*Nucula brogniarti* Lea, Cont. to Geol., Dec., 1833, p. 82, pl. 3, fig. 61.
*Leda cœlata* Con., Proc. Acad. Nat. Sci., Phila., 1854, p. 29.
*Nuculana cœlata* Con., Am. Jr. Conch., vol. 1, 1865, p. 13.
*Leda brongniarti* de Greg., Mon. Faun. Eoc., Ala., 1890, p. 187, pl. 22, figs. 27-29.
*Leda cœlata* Dall, Trans. Wag. &c, vol. III, 1895, p. 578-579.

*Conrad's original description.*—Shell ovate, elongated, with irregular undulated ridges ; anterior submargin with three minutely crenulated, carinated lines diverging from the apex ; beaks nearly central. Length, half an inch.

This species is readily identified, and the type is probably one of the three specimens in the Conradian collection at the Phila. Academy.

The surface ornamentation of this species is rather unique. Two to four concentric folds usually appear near the lower margin of the shell ; above, towards the beaks true concentric lining is limited to microscopic increments of growth. However, superimposed on this system of ornamentation is another, appearing at first sight to be concentric markings about the umbonal region, but dipping down and passing out at both anterior and posterior margins. Of these heavier pseudo-concentric ridges there are a dozen or fifteen larger ones on the upper and medial portion of the shell. But as they extend over the basal portions they become much finer. There are, as Conrad says, "three minutely crenulated, carinated lines diverging from the apex" with hints at short intermediate ones. Radiating from the umbo to the anterio-basal margin there is a slight depression, and it is as the pseudo-concentric lines cross this slight depression that they dip down and extend out laterally across the concentric structure. The teeth are V-shaped and strong, and it is doubtful whether the valves could be disunited without fracturing the teeth.

We know this species only from the Claiborne sand bed at Claiborne, Ala.

The specimens figured are from this locality and are in the Paleontological Museum at Cornell.

**Leda cœlatoides** n. sp., Pl. 23. Fig. 10.

*Specific characterization.*—For general outline and ornamentation, see pl. 23, fig. 10. Pseudo-concentric lines far more numerous on the face of the shell than in *cœlata*, and lacking entirely the downward dip as they approach the umbonal ridge. Shell less protracted than *cœlata*. It may be considered as about midway between *cœlata* and *multilineata* Conrad.

*Type and specimen figured.*—Paleont. Mus. Cornell Univ.

*Locality and horizon.*—Wautubbee, Miss., St. Maurice stage.

**Leda multilineata** Conrad, Pl. 23. figs. 11, 12.

*L. multilineata* Con., Proc. Acad. Nat. Sci. Phila., 1855, p. 258. Pl. 14, fig. 4 of Wailes' Agr. and Geol. of Miss., 1854.

*L. multilineata* Dall, Trans. Wag. &c., III, '98, p. 588, pl. 25, figs. 11, 11, a.

*Conrad's original description.*—Ovate-elliptical, inequilateral ventricose, with fine, sharp concentric lines which are somewhat undulated: anterior side rostrated, with closely arranged, radiating minute, tuberculated striæ; posterior side with unequal, fine radiating lines, a few of which are very distinct; a few radiating lines are continuous near the base over the middle of the valves. Allied to *N. cœlata* but very distinct.

This species was described from Jackson, Miss., and is not rare in the Jackson beds of Louisiana also. So far as we are aware the species does not occur in the Claiborne stage, but is found not unfrequently in the St. Maurice at various localities in Mississippi. It appears to have suffered but few changes during its long banishment from southern waters during the Claiborne age, still, the Jacksonian forms are quickly separated from the St. Maurice by their greater height medially, i. e. they are a little more triangular in outline, with dorsal line more flexed at the beak, or not so parallel with the basal margin as is the case with the St. Maurice specimens. Then too, the posterior radiating lines on the latter are coarser, tending to more of a pronounced alternation in size, with coarser granules.

*Type.*—Donated to the Phila. Acad. by State Geologist Wailes, 1855.

*Specimen figures.*—C. U. Paleont. Mus., (Wautubbee, Miss).

*Horizons and localities.—St. Maurice stage :* Wautubbee, Miss. Also at Hickory and near Enterprise, Miss. (Dall). *Jackson stage :* Jackson, Miss. ; Montgomery, and at various localities on the Ouachita River, La.

**Leda houstonia** Harris, Pl. 23. Fig. 13.

*L. houstonia* Harris, Proc. Phila. Acad. Nat. Sci., 1895, p. 47, pl. 1, fig. 5.

*L. houstonia* Dall, Trans. Wag. &c., III, 1898, p. 578.

*Harris's original description.*—General form as figured ; concentric lines scarcely discernible except where they pass over the umbonal ridge ; post umbonal slope traversed by one raised line extending from the umbo to near the extremity of the valve ; sometimes as many as eight or ten raised radiating lines appear near the posterior sub-margin.

*Type and specimen figured.*—Texas State Univ.

*Localities and horizon.—St. Maurice stage :* Alabama bluff, Trinity River, Houston Co. ; between Orrell's and Evergreen Crossing, Elm Cr., Lee Co. ; along Elm Cr. from Orrell's to Price's Crossing, Texas. Specimens observed in the Phila. Acad. collection are labelled "*Leda* (*Nuculana*) *subtrigona* Con. ? S. Carolina."

**Leda plana** Lea, Pl. 23. Figs. 14-17.

*Nucula plana* Lea, Cont. to Geol. Dec. 1833, (Dec.) p. 199, pl. 6, fig. 213.
*Nucula pulcherrima* Lea (young sp.), Cont. to Geol., '33, p. 84, pl. 3, fig. 63.
*Nuculana plana* Con., Amer. Jr. Conch., vol. 1, 1865, p. 13.
*Nuculana plana* Cossmann, Notes Compl. 1893, p. 15.

*Lea's original description*,—Shell an obtuse triangle, very transverse, very much compressed, concentrically striate, and transversely folded on the side, sulcate on the umbonial slope, substance of the shell thin; beaks obtusely angular, pointed; lunule and escutcheon both nearly linear; anterior series of teeth straight; posterior series of teeth incurved; teeth small numerous, angular; fosset large, subtriangular; cicatrices imperceptible; cavity on the shell very flat, showing the transverse folds; nacre not pearly.

Diam. . . . Length . . . Breadth . . .

A single and imperfect valve only of this species has come under my notice. There are however, characters enough remaining to satisfy me of its being different from those before described. It most resembles the *pulcherrima*. That shell has not, however, the remarkable folds and striæ of this species. These striæ, on the anterior part, are combined, two or three together, leaving a furrow between each association. On the posterior part, these striæ are single, but disordered by the transverse folds, which exist only on that part of the valve.

Cossmann evidently found a fragment of this rare species in the barrelful of sand he had shipped from Claiborne.

A fragment in our own collection from the "sand" bed (fig. 15) shows the very characteristic markings on the posterior portion of the shell, i. e. broad undulations bearing very finely incised concentric lines,—undulations subdividing into two or three folds standing out in strong relief as they pass the umbonal angle and over the post-umbonal slope.

The beautiful large impression of the exterior of a nearly perfect specimen found on the Neuse River, N. C., has been used for making the gutta-percha cast shown on pl. 23, fig. 14. Here we see the true shape of an adult shell. Note the general lack of folds on the anterior portion and the slight depression or channel extending from beak to anterio-basal margin. The fragment from Claiborne, here enlarged, shows clearly that Lea was correct in saying that the substance of the shell is thin and that the undulations show plainly within. This we regard as one of the most beautiful of our Eocene species. It is, however, exceedingly rare. Among various Ledas submitted to us for study by Hon. T. H. Aldrich were two specimens (figs. 16, 17) labelled apparently correctly *pulcherrima* Lea; but there is no doubt in the mind of the present writer that these are simply the young of *plana*. They are from typical Claiborne at Baker's Bluff, Ala. Lea did not see the umbonal or earlier portions of his *plana*, nor was his *pulcherrima* quite old enough to begin to show the undulations so characteristic of this species.

*Type.*—No. 5998, Coll. Phila. Acad. (Lea Coll.)

*Horizon and localities.*—Claiborne Eocene, Claiborne sands, Claiborne, Ala.; 17 miles above Newbern, Neuse River, N. C.

*Specimens figured.*—(Figs. 14, 15) Cornell Univ. Paleont. Coll.

**Leda trumani** n. sp., Pl. 23. Figs. 18-19.

*Specific characterization.*—Form and general dimensions about as represented in the illustrations (though more pointed posteriorly as that portion is broken off in the specimen figured); general surface marked by coarse, very sharply defined concentric lines, abruptly ceasing with a slight nodular enlargement at the umbonal ridge; post-umbonal slope with two sharply defined radiating nodular ribs, marking, with the row of nodules mentioned above, the limits of two concave, radiating interspaces the lower of which is horizontally, finely striate, the upper with oblique lines increasing in strength upwards; escutcheon and lunular spaces each with a pair of simple rays radiating from the beak and recurving into the hinge line half way to either extremity (see fig. 19).

Named in honor of Hon. Truman H. Aldrich whose interest in Eocene mollusca practically inaugurated pre-Claibornian paleontological investigation in our Southern States.

*Type and specimens figured.*—Deposited, Pal. Museum, Cornell Univ.

*Horizon and localities.*—St. Maurice Eocene. Base of Claiborne Bluff; Hamilton Bluff, Ala. Three and six miles W. N. W. of Orangeburg, S. C. Ft. Gaines, Ga.

**Leda opulenta** Conrad, Pl. 23. Figs. 20-22.

*Nucula opulenta* Con., Foss. Sh. Tert. Form., 1833, p. 46.
*Nuculana opulenta* Con., Am. Jr. Conch, vol. 1, 1865, p. 13.
*Leda opulenta* Dall, Trans. Wag. &c., III, 1895, p. 578 and 587.

*Conrad's original description.*—Elongated, compressed with regular, concentric sulci; anterior side rostrated, and with a submarginal carinated line; space between it and the margin with regular, prominent striæ; beaks posterior to the middle.

*Type.*—Phila. Acad. Nat. Sci.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Localities and horizon.*—*St. Maurice* (var. *compsa* Gabb): Rio Grande, 6 miles above Starr-Zapata Co. line; Brazos River, Mosley's ferry, 60 yards below mouth of Little Brazos andon the Little Brazos on Mosley's ferry road; Cedar Cr., N. E. Cor. Wheelock League; Campbell's Cr., Robertson Co.; 3 miles N. E. Crockett, Houston Co.; Collard's Farm, Town Branch, Brazos Co.; Sàn Miguel Cr., S. E. Cor. Frio Co., Tex.; Monroe well, 1200 ft. deep, La.; 6 miles W. N. W. of Orangeburg, S. C.

Var. *hammetti*: Hammett's Branch, La. (pl. 23, fig. 23). *Claiborne* (typical): Claiborne sand, Claiborne, Ala.

In the varietal form referred to a distinct species (*compsa*, Jr. Acad. Nat. Sci. Phila., vol. 4, 1860, p. 387, pl. 67, fig. 57) by Gabb the space "with regular prominent striæ" is wider than in the Claiborne form; the shell itself, however, is usually smaller (pl. 24, figs. 1, 2).

The new variety *hammetti* is smaller, more robust and arcuate.

**Leda magna** Lea, Pl. 24. Figs. 3, 4.

*Nucula magna* Lea, Cont. to Geol., Dec., 1833, p. 197, pl. 6, fig. 211

*Lea's original description.*—It is ventured to place this name upon the fragemnt of a *Nucula*, which differs on the exterior, very much, from any species, fossil or recent, which has come under my notice. It possesses transverse folds on the sides, which lie closely to, and are beautifully parallel to each other. These terminate in a smooth plane, on the umbonial slope which is flattened. A straight furrow, or channel, passes along the posterior dorsal margin, in which are striæ, slightly oblique. The posterior series of teeth so far as it exists in the fragment, is straight, and possesses nineteen angular teeth. From the appearance of this part of the series, I should not be surprised if it possessed almost as many more. The substance of the shell is thick, and it is suspected that when found perfect, it will prove to be the largest species yet described. This fragment certainly warrants such a conclusion.

Since Lea's time Cossmann and Aldrich have found fragments of this species in the Claiborne sands. Two fragments from the latter's collections we have herewith figured. Very likely Aldrich's *lisbonensis* should be referred to a variety of this species as the markings agree exactly. It would appear, however, that the Claiborne specimens are not so elongated as those from the St. Maurice stage.

*Type.*—Phila. Acad., Lea Coll., No. 5996.

*Horizon.*—Claiborne sand.

**Leda magna**, var. **lisbonensis** Aldrich, Pl. 24. Figs. 5-7.

*L. lisbonensis* Aldr., Bull. Amer. Pal., vol. 1, 1895, p. 69. pl. 6, fig. 4.

For the original characterization, see the above reference.

*Type.*—Aldrich Coll., John Hopkins Univ.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—From Lisbon, deposited in the Paleont. Mus. Cornell Univ.

*Localities.*—St. Augustine, Tex. ; 200 yds. below the mouth of Negreet Bayou ; 3 miles S. E. of Negreet P. O. ; Monroe well, 1200 ft., La. ; St. Maurice road, 1 mile S. W. of Winnfield Marble Q'y, La. ; Lisbon and Hamilton Bluff, Ala. ; 27 miles above Newburn ; Ft. Gaines, Ga., ? Neuse River, between 16 and 17 miles above Newburn, N. C.

At the last mentioned locality a few large casts have been collected perhaps belonging to this species, but their characteristics are not obvious. Lisbon seems to be the place where this species is best exhibited. The Texas and Louisiana specimens so far found are much smaller than the Lisbon types. They show a slightly curved rib on the escutcheon area more plainly than do those from Lisbon, but the characteristic, very oblique striation over this area they exhibit very indifferently.

**Leda magnopsis**, n. sp., Pl. 24. Fig. 8.

In a coquina-like rock labelled "Rock Swamp" a few miles south-east of Springfield, S. C., is found a fragmentary *Leda* which we took at first to be Lea's *L. magna*. But instead of having a smooth radial band extending down the post-umbonal slope as in *magna* and in *lisbonensis*, the concentric liration swings over this area but little diminished in strength. Just behind, there is a deep radial furrow, but the concentric or diagonal lining is not to be seen between this furrow and the margin of the shell as in *lisbonensis* or Lea's species.

*Type.*—Paleont. Lab. Cornell Univ.

**Leda bastropensis**, Pl. 24. Figs. 9, 10.

*Leda bastropensis* Harris, Proc. Phila. Acad. Nat. Sci. 1895, p. 46, pl. 1, fig. 3.
*Leda bastropensis* Dall, Trans. Wag. &c., '95, p. 578.

*Harris's original description.*—General form as figured; medial portions of the valves with regular, strong, concentric striæ; striæ obsolete on the anterior end and on the post-umbonal slope, the latter with a shallow furrow extending from the umbo to near the extremity of the valve; within the valve a raised line or ridge, emanating from the umbonal region and extending along beneath the hinge finally terminates in the middle of the posterior end and is there slightly enlarged.

This species differs from *L. plicata* Lea in its lack of striation over portions of the exterior, and the more central positions of the umbones. From *L. mater* Mr., *bastropensis* is distinguished by its want of anterior radiating sulci, its lack of post-umbonal striation and by its form. This is readily distinguished from *L. albirupina* Har., since it lacks the smooth, Yoldia-like aspect about the umbones so characteristic of that species.

*Type and specimen figured.*—Univ. Tex. Coll.

*Localities and horizon.*—St. Maurice stage at Starr-Zapata Co. line on the Rio Grande; and 1 mile below Milam-Burleson Co. line, Brazos River, Tex.; Ft. Gaines, Ga.?

*Leda bella* Conrad, Pl. 24. Figs. 11-16.

*Nucula bella* Con., A. J. S., 1833, vol. 33, p. 343.
*Nucula plicata* Lea, Cont. to Geol., 1833, p. 85, pl. 3, fig. 64.
*Leda bella* Con., Proc. Phila., Acad., 1854, p. 29.
*Nuculana plicata* Con., Am. Jr. Conch., vol. 1, 1865, p. 13.
*Leda plicata* de Greg., Faun. Ala., '90, p. 189, pl. 23, figs. 6-10.
*Nuculana plicata* Cossm., Notes Compl. '93, p. 15.

*Leda bella* and *plicata* Dall, Trans. Wag. &c, '95, III, p. 578.

*Conrad's original description.*—Shell ovate, elongated, rostrated, with numerous regular concentric striæ, and two carinal lines on the anterior submargin diverging from the apex : on the posterior side is a slight furrow from the apex to the base. Length, half an inch.

*Locality.*—Claiborne, Ala. London clay.

This species is at once distinguished from *media* by its coarser, continuous lines of growth, more anterior beaks, less conspicuous swelling between the siphons, its greater rarity, less inflation and lack of any serration of post-umbonal radiating ridge. Our specimens do not show the anterior, radiating depression so plainly as does Lea's type. Some specimens, especially from the Orangeburg district, show a slight swelling along the posterior basal margin. Young, thin specimens show an interior radiating ridge, from beak to posterior end (as per fig. 14). Old, thickened specimens show a vertically striated, minute, triangular area beneath the hinge teeth, just in advance of the cartilage (fig. 13).

*Type.*— Conrad Coll., Phila. Acad.

*Horizon.*—Claibornian and St. Maurice Eocene.

*Specimens figured.*—Paleont. Coll. Cornell Univ.

*Localities.*—Claiborne, Ala. Six mile W. N. W. of Orangeburg, S. C. Marble Q'y, Hammett's Branch, La.

**Leda pistorupes**, n. sp., Pl. 24. Figs. 17,18.

*Specific characterization.*—Size and general form as indicated by the illustrations and explanations ; rather thin ; marked about the umbo and base by moderately fine concentric lines, but medially by three or four folds on which are engraved almost microscopic, very regular, concentric striæ ; posterior radii arranged somewhat as in *bella*, but with obvious raised concentric, sharp folds ; interior very much as in *bella* though naturally showing marked concentric undulations.

*Types*—Aldrich's collection, Birmingham, Ala.

*Horizon.*—Claiborne stage.

*Locality.*—Baker's Bluff, Tombigbee River, Ala.

**Leda media** Lea, Pl. 25. Figs. 1-4.

*Nucula media* Lea, Cont. to Geol. 1833, p. 83, pl. 3, fig. 62.

*Nuculana media* Con., Am. Jr. Conch., 1865, vol. 1, p. 13..
*Nucula media* Ald., Geol. Surv. Ala., Bull. 1, 1886, p. 49.
*Nuculana media* Cossmann, Notes Compl. 1893, p. 15.
*Leda media* Dall, Trans. Wag. &c., 1895, p. 578.

*Lea's original description.*—Shell elliptically transverse, somewhat inflated ; rounded before, produced and truncated behind, equilateral, furnished with fine concentrical folds in the middle and three ribs on each valve behind ; anterior part smooth ; substance of the shell thin ; lunule none ; beaks very small, pointed ; anterior series of teeth arched—posterior series inflected ; teeth small, pointed, angular, diminishing in size towards the beak ; fosset scarcely perceptible ; cicatrices obsolete ; cavity of the shell rather shallow, having its channel interrupted by a callus ; margin entire ; nacre not pearly.

Diam. .1, Length 3-20ths, Breadth 7-20ths of an inch.

* * * * * * * *

The folds are minute and remarkably regular. Becoming obsolete as they approach the anterior margin, they there vanish altogether as if erased by attrition. These folds terminate posteriorly very abruptly at the first rib, of which there are three on each valve, passing from the beak to the posterior margin. The central rib is the largest and disposed to imbricate. A remarkable callus is placed directly in the channel of the posterior part of the shell. It is disposed to be polished inside and out.

Two specimens in a tray in the Conradian collection at the Academy prove that as Conrad remarks (Am. Jr. Conch. 1865, vol. 1, p. 191 b) that Lea's *media* is equivalent to his *equalis*. But the description he gives of the shell (Foss. Sh. Tert. Form., p. 46) is quite unrecognizable, Lea's figure and description are remarkably correct. De Gregorio on pl. 3 of his Claiborne work has given some very poor and incorrect figures of this species.

Of the three posterior "ribs" mentioned by Lea, the inner is the least conspicuous and it extends but half way to the posterior termination of the shell.

*Type.*—No. 5411, Phila. Acad. Coll.

*Specimens figured.*—Paleont. Mus., Cornell Univ.

*Localities and horizon.*—*St. Maurice :* Lisbon (slender variety, fig. 4); Marble Quarry, La. *Claiborne :* Claiborne sands.

**Leda catasarca** Dall, Pl. 25. Fig. 5, a.

*Leda catasarca* Dall, Trans. Wag., III, '95, p. 588. pl. 32, fig. 13.

*Dall's original description.*—Shell small, very plump, nearly equilateral, concentrically sculptured, with on the beaks and body rather wide, flattish riblets, more crowded ventrally, obsolete dorsally behind and on the dorsal and anterior portions in front, lunule very narrow, excavated, with the valve margins slightly pouting; the escutcheon similar, wider, with an excavated, obliquely grooved furrow outside of it, with rounded outer edges, the whole forming a conspicuous, lanceolate area extending from the point of the rostrum to the beaks; anterior end of shell rounded, base arcuate, posterior end with a short, bluntly pointed rostrum, hinge solid, with about sixteen anterior and fourteen posterior V-shaped teeth; chondrophore small, subumbonal; the rostrum without an internal ridge, the pallial sinus small. Length 5.2, alt. 3, diam. 2.5 mm.

This interesting little species seems to be rather common in beds of the Wautubbee horizon. It differs from *L. robusta* Aldrich in details of sculpture, especially on the escutcheon.

There is a somewhat noticeable flattening of the shell on passing from the middle to the rostral area, not so marked as in *ozarkola* nor so sharply defined as in *parva*, still noticeable (see fig. 12, a).

This species differs from *quircollis* in its more marked median inflation, somewhat greater size, coarser concentric ornamentation on the central portion of the shell but lack of same near the posterior and anterior extremity. It is distantly related to *robusta* Aldrich.

**Leda kittensis**, n. sp., Pl. 25. Fig. 6.

*Specific differentiation.*—Size and appearance as illustrated; surface marked by about 30 concentric raised lines about one-half as wide as the interspaces; lines stronger medially and posteriorly than anteriorly; umbonal angle sharply defined by a 90 degree angle; concentric lines changing direction slightly, bending upward, just before reaching the sharp ridge; post-umbonal slope marked very obliquely by the continuation of the raised lines above described, lines of about one-third the strength of those on the main body of the shell; escutcheon very small, scarcely perceptible; lower portion or the umbonal slope seemingly gouged out concavely, above with a convex swell over both of which the oblique lines evenly swing (convex swell, marking the termination of the posterior series of teeth); within, showing two series of teeth, the anterior but slightly longer than the posterior, both becoming weak and finally vanishing exactly at the apex; siphonal ridge emanating near the beak within and increasing in size and terminating conspicuously almost at the margin between the siphons.

Length 7.3 mm. Height 4 mm. Semi-diameter 1.5 mm.

*Type.*—U. S. Nat. Museum, Sta "4589" Kitts Ravine, Calhoun Co., S. C.

**Leda crassiparva**, n. sp., Pl. 25, Figs. 7-9.

*Specific characterization.*—Size and general form as indicated by the figures; substance of the shell thick; surface appearing smooth except in the post-basal region; radiating post-umbonal depression extending from beak to point on the basal margin somewhat in advance of the posterior termination or beak; lunule faintly indicated by depressed lines; escutcheon defined by the usual curved middle rib (fig. 8); eminence between siphons small, hemispherical.

This little shell seems at first closely allied to the slightly larger *L. catasarca* Dall from Wautubbee. But it lacks the banded surface markings of that species, and the radiating, post-umbonal channel terminates quite differently in the two species. Specimens in Aldrich's collection (fig. 9) show that in general the shell is somewhat longer than the type (figs. 7, 8).

*Type.*—Paleont. Mus. Cornell Univ.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Figs. 7, 8, Cornell Univ.; Fig. 9, Aldrich Coll.

*Locality.*—Lisbon, Ala.

Conrad's *linifera* from the Jackson beds of Mississippi and Dall's *canonica* as well as his var. *chipolana* Trans. Wag. III, p. 591, seem to be descendants of this species, but real relationships seem impossible to establish without more and better figures of the later forms. The latter seem to be only of about one-half the linear dimensions of *crassiparva*.

**Leda ozarkola**, n. sp., Fig. 25. Figs. 10-14.

*Specific characterization.*.—Size and general appearance as indicated by the illustrations and explanations; extremely inflated medially, gradually rounding to the anterior margin but much more suddenly depressed posteriorly where the shell is no more inflated than the majority of members of this genus; with fine even striation on the lower third of the shell surface, though in general above, appearing smooth; umbonal ridge rather sharply defined, with but slight traces of concentric markings; on the flat, radial space between the umbonal ridge and the margin of the escutcheon the counterpart of concentric striation appears in the form of even, sharply defined, very oblique lining, the moderate, slightly raised escutcheon shows this lining but imperfectly; lunule nearly as long, but narrower than the escutcheon, set off from the general shell surface by a narrow, shallow channel showing even, oblique growth-lines as on the post-umbonal slope before described; posterior and anterior rows of teeth strong, about equal.

In rare instance there are two or three radiating rays extending from beak to post-basal margin, suggesting those of *L. houstonia*. This shell would seem to be *L. calcarensis* Conrad, but from the description and figure given of that species we are at a loss to know whether the ventricose condition is limited to the medial portion of the shell, as in our species, whether the concentric lines cover the whole surface or not, whether the "pointed" rostrum is as blunt as figured and whether the dimensions as given in the description are of an adult form or not. Several of our specimens from Ozark are an inch in length, Conrad gives 7-16 as the length of his specimen.

It is quite probably a descendant of *milamensis.*

*Types.*—Paleont. Mus. Cornell Univ.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Localities.*—Hamilton Bluff, Ala. (very abundant); Ozark, Ala. (large, fine casts).

**Leda wautubbeana**, n. sp., Pl. 25. Fig. 15, a.

*Specific characterization.*—Size and form as indicated by the figure and explanation; shell thin, flat, practically smooth medially; anterior with a sharply defined radiating furrow; posterior with two sharply defined radiating ribs, lunule and escutcheon scarcely defined.

*Type and specimen figured.*—Wautubbee, Miss. In Paleont. Mus. Cornell Univ. (No. 15 a is from Newton, Aldrich Coll.

*Horizon.*—St. Maurice Eocene.

*Localities.*—Wautubbee, and Newton, Miss. ; Calvin, La.

*Species of Leda not well defined, and of uncertain horizon.* Species from Vanuxem's cabinet, Orangeburg District, S. C.

**Leda vanuxemi** Dall, Pl. 25. Fig. 16.

*Nucula mucronata* Con. *non* Sow., Jr. Phila. Acad., vol. 1, 1848, p. 128, pl. 14, fig. 2.
*Leda vanuxemi* Dall, Trans. Wag., III, '95, p. 578.

*Conrad's original description.**—Elliptical, convex in the middle, with equal, laminated, not closely arranged lines, about 17 in number ; anterior side longest, the end acutely pointed ; a submarginal furrow emarginates the base ; posterior side slightly contracted, end obtusely rounded or subtruncated. Length 9-10. Height 6 [.6 in.?]

**Leda carolinensis** Conrad, Pl. 23. Fig. 17.

*Nucula carolinensis* Con., Jr. Phila Acad., vol. 1, p. 128, pl. 14, fig. 3.

*Conrad's original description.*—Somewhat elliptical, convex, with rather closely-arranged prominent concentric lines, wanting on the posterior side, which is rather shorter than the anterior and regularly rounded at the end ; anterior submargin with a narrow groove, bounded by a subcarinated line ; anterior side narrowed and rather obtuse at the end. Length ½. Height ¼.

**Leda subtrigona** Conrad, Pl. 25. Fig. 18.

*Nucula subtrigona* Con., Jr. Phila. Acad., vol. 1, 1848, p. 128, pl. 14, fig. 4.

*Conrad's original description.*—Subtriangular, ventricose, nearly equilateral, with numerous, prominent concentric lines ; anterior side pointed, flexuous ; submargin angulated : anterior margin sinuous, end angular ; ligament margin straight, basal margin profoundly rounded. Length 2-3. [⅜ Proc. Phila. Acad., '47, p. 297]. Height ¼ nearly.

**Leda calcarensis** Conrad, Pl. 25. Fig. 19.

*Nucula calcarensis* Con., Jr. Phila. Acad., vol. 1, 1848, p. 128, pl. 14, fig. 5.

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*Descriptions first published in Proc. Phila. Acad., 1847, p. 297.

*Conrad's original description.*—Subovate, ventricose, with minutely closely arranged concentric lines; anterior side longest, pointed, slightly recurved, without a submarginal groove or fold; base profoundly rounded. Length 7-16. Height ¼.

"All the preceding fossils are from the Eocene rocks of St. Matthew's Parish, Orangeburg District, South Carolina. Not one species of this locality is known in the Lower Eocene of Claiborne or elsewhere, nor in the Upper Eocene of Vicksburg, and therefore the relative age of the deposit is uncertain but it unquestionably belongs to the Eocene period. Near this rock Mr. Vanuxem found quite a different class of shells consisting of casts in indurated clay. The relative position is undetermined. Two of the shells are described and named *Tellina subequalis* and *Lutraria petrosa.*"

**Adrana aldrichiana** Harris, Pl. 25. Figs. 20-21.

*L.* (*Adrana*) *aldrichiana* Harris, Proc. Phila. Acad. Nat. Sci., 1895, p. 47, pl. 1, fig. 6.

*Harris's original description.*—Size and general form as indicated by the figure; exterior smooth and polished; within smooth; sinus small; posterior [anterior] row of teeth much the longer.

The type specimen is compressed vertically, the umbo should be somewhat more elevated than is represented by the figure. The type is in the Aldrich collection of Johns Hopkins Univ. It was from a locality half a mile below Mosley's ferry on the Brazos River, Texas. A cast of elongate Taxodont probably of this species is in our collection from the region about Roberta, La. (fig. 20).

**"Nucula capsiopsis"** de Gregorio, Pl. 25. Figs. 22-23.

*N. capsiopsis* de Greg., Mon. Faun. Eoc. Ala., '92, p. 187, pl. 22, figs. 23-24.

*De Gregorio's original description.*—Testa minuta, tenuis, elegans, elliptica, æquilatera, lævigata; umbone minimo, centrali; cardine lineari; dentibus 6 ad latus. L. 3 mm.

C'est un très petite coquille, mais ayant des characterès bien définis. —(Coll. mon Cabinet).

This very little, presumably immature, specimen de Gregorio describes along with his material coming mainly from the Claiborne sands, but he gives no definite locality for this particular species. We have found nothing of the kind from the mid-Eocene of Alabama.

**Yoldia claibornensis** Conrad, Pl. 25. Fig. 24.

*Nucula claibornensis* Con., Jr. Phila. Acad. Nat. Sci., vol. 1, p. 131, pl. 14, fig. 22.

*Yoldia claibornensis* Dall, Trans. Wag. III, 1898, p. 594, 596.

*Conrad's original description.*—Ovate-acute, compressed, polished, entire; ligament and anterior dorsal margin nearly rectilinear; anterior side longest; posterior end regularly rounded; anterior basal margin nearly straight. *Locality*, Claiborne, Alabama.

We have heretofore been accustomed to refer the large Yoldias at the base of the bluff at Claiborne to *claibornensis*.

But in the National Museum Collection there are small, smooth specimens from the sand bed which Dall evidently regards as the true *claibornensis*. In this he is probably correct as Conrad seems not to have collected at all carefully from the St. Maurice bed at the base of the bluff. But the type is lost and it impossible to know for certain from which horizon Conrad's specimens came. If those derived from the lower horizon are not the same species as those from the "sand", clearly they should be given a distinctive designation. Dall accordingly names the lower, *psammotæa* (see below, by a slight *lapsus* referred to the "Claiborne sands", p. 596, *op. cit.*).

We have no specimens from the Claiborne horizon.

**Yoldia psammotæa** Dall, Pl. 25. Figs. 25-31

*Y. psammotæa* Dall, Trans. Wag., III, 1898, p. 596, pl. 34, fig. 20.

*Dall's original description.*—Shell smooth, or with faint incremental lines, inequilateral with low beaks, the dorsal and ventral margin sub-parallel; valves elongated, rounded in front and behind, the posterior part somewhat compressed and attenuated; anterior end with a moderate gape; lunule and escutcheon elongated, very narrow, almost linear.

Long. 21, alt. 9, diam. 6 mm.

This species is represented by two specimens with the valves closed and filled with a rather hard matrix, so that the hinge characters are inaccessible. It is clearly distinct from any of the described species of the American Eocene, and peculiar in its elongate solenoid form. It cannot be confounded with *Y. claibornensis* Conrad, from the same horizon. It would find a place in the section *Orthoyoldia* Verrill.

By a slight confusion of horizons Dall refers this to the Claiborne sand instead of the St. Maurice calcareous clays at the base of the bluff whence it actually came.

This form we have heretofore regarded as but a large well developed *claibornensis*. It is a very widely distributed St. Maurice species, varying considerably, however, from state to state as traced from Mexico to the Carolinas. It is most abundant and typically developed just below the ferry at Claiborne, Ala., but is rarely found in a perfect state of preservation. It is common also at Lisbon and Hamilton Bluff.

The extent of striation upon the surface varies greatly even at the type locality. Sometimes the incremental lines cover nearly the entire surface. At Vivian, La., a more nearly equilateral form occurs, with stronger striæ, var. *vivianensis* (fig. 31); and 5 miles N. and N. W. of Orangeburg casts showing undulations (fig. 30) are not rare. We have called the latter var. *orangeburgensis* though they may belong to quite a distinct species.

*Type.*—U. S. Nat. Museum.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ., except fig. 28, from U. S. Nat. Mus.

*Localities.*—Smithville, Mosley's Ferry, Cedar Cr., Tex. Noble's Ldg., Roselawn, St. Maurice, Calvin, 1 mile S. of the "Marble Q'y", Chautauqua, La. From Hamilton Bluff to the Upper bluff at Claiborne, Ala. Kitt's Ravine, S. C.

In varietal forms at Vivian, La. and 5 miles N. and N. W. of Orangeburg, S. C.

**Nucula magnifica** Conrad, Pl. 26. Figs. 1-3, 8.

*N. magnifica* Con., Foss. Shells Tert. Form., 1833, p. 37.
*N. sedgwickii* Lea, Cont. to Geol., 1833, p. 79, pl. 3, fig. 58.
*N. magnifica* de Greg., Mon. Faun. Eoc. Ala., 1892, p. 189, pl. 22, figs. 16-19.

*Conrad's original description.*—Shell obliquely subtriangular, very inequilateral, smooth, thick, with obscure reticular striæ; anterior side truncated; posterior side elongated or cuneiform; basal margin crenated; hinge teeth elongated; within pearly or purplish. Length nearly ¾ of an inch. *Locality*, Claiborne, Ala. Cab. Acad. N. S.

So far as we have observed typical *magnifica* occurs only in the Claiborne sand at Claiborne and nearby localities. The umbonal region seems heavy, deep, inturning, when compared with the same parts of individuals from the St. Maurice Stage (var. *mauricensis*, n. var., figs. 4-6). Compare pl. 26, figs. 2 and 3 with fig. 4. Also note that the width of fig. 8 is to its height as 1 : 2.3. The typical older, or *mauricensis* variety as here figured is found at the base of the bluff just above the Upper Landing at Claiborne and at Lisbon, in Alabama and westward into Texas. Likewise in the Orangeburg District of South Carolina, though there, as usual, a tendency is shown to assume something of a true Claiborne aspect.

*Type.*—Phila. Acad. Nat. Sci.

*Horizon.*—Claiborne and St. Maurice Eocene stages.

*Specimens figured.*—Paleont. Mus., Cornell Univ.

*Localities.*—Texas (where according to my MS report to the Texas Survey, 1893, "The specimens have slightly less conspicuous beaks, the center of the lunule is slightly more elevated and the lunule is shorter than in the specimens from Claiborne"): Devil's Eye, Col. Riv. ; Col. Riv. just below the mouth of Alum Cr. ; Smithville ; Little Brazos River, Mosley's Ferry road ; Brazos River 500 yards below the mouth of Little Brazos River ; Cedar Creek, S. E. Cor. Wheelock League ; Elm Creek, Lee Co. ; Campbell's Creek, Robertson Co. ; Sabine River. Louisiana : Sabine River ; Hammett's Branch ; Monroe well ; Columbus, Noble's Landing, Ouachita River. Alabama : Coffeeville ; Lisbon ; base of Claiborne Bluff ; Claiborne sands. South Carolina : 3 and 6 miles W. N. W. of Orangeburg ; 5 miles N. of Orangeburg. North Carolina : 17 miles above Newbern on the Neuse River.

**Nucula ripæ**, n. sp., Pl. 26. Figs. 9-10.

*Specific characterization.*—Form and size as indicated by the figures and explanations ; surface covered with fine, somewhat irregular lines or small folds of growth ; lunular and escutcheon areas broad, with margins of the valves raised or pouting ; no sharply defined radiating lines on these areas separating them from the general surface of the valves, the definition being brought about by fairly well defined obtuse, radiating ridges ;

margins crenulated ; posterior row of cardinal teeth very short (5 or 6) and making an angle of aboat 150° with the anterior ; cartilage pit well marked and very oblique.

*Type and specimens figured.*--Paleont. Museum, Cornell Univ.

*Horizon and locality.*—St. Maurice horizon, at the base of the Upper Bluff at Claiborne, Ala. ; 3 miles W. N. W. of Orangeburg, S. C.

Certain small casts from a very light-colored, sandy compact, clay, 6 miles W. N. W. of Orangeburg, S. C., seem also referable to this species. The same kind of material shows the same kinds of casts 5 miles N. of Orangeburg on Columbia Road.

A very different form, more or less of the *ovula* type occurs in Mississippi, but as our specimens are imperfect and the locality is indefinite it seems inadvisable to assign a specific name to this type (pl. 26, fig. 15).

**Nucula monroensis** Aldrich, Pl. 26. Fig. 11.

*M. monroensis* Ald., Bull. 1, Geol. Surv. Ala., 1886, p. 40, pl. 4, fig. 2.

*Aldrich's original description.*--Shell ovate-elliptical, subangular behind, surface covered with raised, concentric ribs, sharp on the upper edge and sloping down towards the ventral margin ; beaks recurved ; lunule faintly marked, but large ; cavity of the shell rather deep ; margin crenulated.

*Locality.*—Calcareous sand-bed, lower part of Claiborne section, Monroe County, Alabama.

We have not had a specimen of this species for study but owing to the extreme variability of these *Nuculæ* from the St. Maurice beds we are prepared to see this shade into *mauricensis* and even *ripæ* and finally all into *magnifica* when a great amount of material shall have been collected and studied. The type is doubtless with the Aldrich collection in the Museum of Johns Hopkins Univ.

**Nucula ovula** Lea, Pl. 26. Figs. 12-14.

*N. ovula* Lea, Cont. to Geol., 1833, p. 80, pl. 3, fig. 59.

*Nuculana ovula* Con., Am. Jr. Conch, vol. 1, 1865, p. 13.
*Nucula ovula* Har., Bull. Am. Pal., vol. I, 1896, p. 168, pl. 14, fig. 5.

For Lea's original description, see these Bulletins as above cited.

This species in its varietal forms seems to be fairly well distributed in the Eocene series. In the more typical forms the two series of hinge teeth are each somewhat curved and lines drawn tangentially to the mid portions of each would intersect at an angle of 90°, whereas a similar construction about the hinge teeth of *magnifica* would produce a much greater angle (compare figs. 1 and 14). The projecting margins of the valves within the long lunule make a fine distinguishing feature exteriorly. Lea's figure, indicating conspicuous radial striæ is slightly misleading.

*Type.*—No. 5399, Coll. Phila. Acad. Nat. Sci.

*Horizon.*—Midway-Jackson stages.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*St. Maurice and Claiborne localities.*—Claiborne stage, at Claiborne, Ala. St. Maurice stage: in large, typical form at Hickory and Wautubbee, Miss. Flatter, less abbreviated posteriorly and more difficult to distinguish from *magnifica*, 3 and 6 miles W. N. W. of Orangeburg, S. C. In form of casts, good size but flat, Kinston and 17 miles above Newbern, N. C.

**Solemya alabamensis** Harris, Pl. 26. Fig. 16.

*S. alabamensis* Harris, These Bulletins, vol. 2, p. 265, pl. 20, fig. 12.

For original description, see reference above. The type specimen from the uppermost Sabine beds of Alabama seems to be somewhat imperfect about the umbonal region. The specimen herewith figured is from 5 miles N. of Orangeburg, S. C. in association with *Lutraria lapidosa*. It, too, is an internal impression, but the hinge characteristics are well shown, both the ridge below the muscular scar and the nymph supporting the ligament.

*Type.*—Paleont. Mus. Cornell Univ.

*Horizon.*—Uppermost Sabine and St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.;

*Localities.*—Sabine: 4 miles N. of Hamilton Bluff, Alabama River. St. Maurice; Ft. Gaines, Ga.; 5 miles N, of Orangeburg, S. C.

**Venericardia planicosta** Lamarck, Pl. 27; Pl. 28. Figs. 1-3.

For synonymy and original description, see Bull. Am. Pal., vol. 1, p. 172, pl. 14; vol. 2, p. 246, pls. 15, 16.

Conrad's *Cardita vigintinaria* (Jr. Phila. Acad., vol. 1, '48, p. 129, pl. 14, fig. 12) and perhaps *C. carolinensis* ditto, p. 128, would seem to belong there. Both were omitted by Conrad in his list of 1865 (Amer. Jr. Conch., vol. 1.)

Of the four fairly distinct types of *planicosta* recorded from the Sabine (Lignitic) horizons (Bull. Am. Pal. ,vol. 2, pl. 16) two, designated for convenience of reference $\gamma$ and $\delta$ continue into higher beds, $\gamma$ through the St. Maurice and $\delta$ also through the Claiborne and Jackson stages. Slight modifications of $\delta$ reached the old country in mid-Eocene times and were there first described as *planicosta* by Lamarck. So far as our collections go it is the English Bracklesham specimens that furnish the nearest replicas of the American forms. At Alum Bay or Whitecliff Bay on either end of the Isle of Wight we have obtained small specimens of this species which are very like those from Texas. Specialized and decadent varieties of this stock tend to broaden and obliterate the costation in later stages of growth. This is especially the case in America. Most specimens of "*densata*" of Conrad (pl. 27, figs. 1-3) show this tendency. It is much better shown in the *potapacoensis* of the Maryland Survey Reports. Most persistent of all is this feature in var. $\gamma$ (pl. 28, fig. 3 ; pl. 29, fig. 1). However, amongst any and all of these, the reversion to the sharply defined ribbing (pl. 28, fig. 1) is very frequent. Conrad has apparently given two names to these clear-cut forms, *vigintinaria* and *mooreana*.

The American specimens, on the whole, show higher beaks than the European ; especially is this the case with the great early specimens illustrated in vol. 2, pl. 15, or this work. Compare fig. 1 of that plate with fig. 2, pl. 27, of the present volume and it will appear how, in mid-Eocene time there was a close approaching to the European type. The beak is not far above the most anterior point in the margin of the shell, and beneath this point there is an oblique truncation of the margin, noticeably different from the fullness of the margin at this place as shown in form $\beta$, pl. 15, fig. 1 (vol. 2).

Where there are great numbers of very young of *planicosta* and small *rotunda*, as in the Claiborne "sand", it is something of a task to separate the two, for each show a nearly circular outline and have crenulated ribs. However, it will be noticed that *planicosta* has on an average about 26 ribs to *rotunda's* 22. The ribs on the post-umbonal slope of *rotunda* tend to be far apart and show unusually sharp or large crenulations. *Planicosta* is finely and evenly ribbed and crenulated. In somewhat larger shells it will be found that the crenulation of the ribs of *planicosta* become obsolete basally (pl. 27, fig. 1 a) while in *rotunda* they increase in size and become hoods or inverted funnels (pl. 28, figs. 4 and 5.

The variety *γ*, as before stated, comes up from the upper Sabine beds and is abundant at Hamilton Bluff and Lisbon, Alabama—beds of St. Maurice age. Dall regard this the same as the "*Cardita hornii*" of the West Coast. We have seen it in the St. Maurice, from the Alabama localities and 200 yards below the mouth of Bayou Negreet on the Sabine River, La.

*Specimens figured.*—Paleont. Coll. Cornell Univ.

*Horizons.*—Midway to Jackson inclusive (in America).

*Localities from the St. Maurice stage.*—Texas : Practically where fossiliferous beds are found, from the Rio Grande to the Sabine ; we have over 50 entries from this state in our old Texas MS report. Louisiana : Hammett's Br., Monroe well, Chautauqua, near Long Pt., ½ mile S. of Alabama Ldg., Ouachita River ; Winona ; Reid's Plantation (S. 29, 19 N., 4 W.). Mississippi : Wautubbee. Alabama : Hamilton Bluff, Lisbon ; base of Claiborne Bluff ; Coffeeville. Ga. : Ft. Gaines. South Carolina : 3 and 6 miles W. N. W. of Orangeburg ; Rocky Swamp, 5 miles S. of Springfield.

In the Claiborne stage at Claiborne, Ala.

**Venericardia rotunda** Lea, Pl. 28, figs. 4-7, Pl. 29, Figs. 2-5.

*V. rotunda* Lea, Cont. to Geol., 1833, p. 70, pl. 2, fig. 48.

*V. transversa* var. *rotunda* de Greg., Mon. Faun. Eoc. Ala., p. 212, pl. 13, figs. 6-13.

? *C. subrotunda* Con., Jr. Phila. Acad., Nat. Sci., vol. 1, 1848, p. 129, pl. 14, fig. 11. Conrad omits this name in his list of '65.

*Lea's original description.*—Shell rotund, inequilateral, slightly inflated, longitudinally and closely ribbed; substance of the shell rather thick; lunule small, ovately cordate; beaks slightly elevated, recurved; ribs about twenty-six and furnished with closely set arched scales; teeth rather oblique; cicatrices rather impressed; cavity of the shell somewhat deep and rounded; margin rather largely crenulate.

Diam. .6, Length 1, Breadth 1 inch.

*Observation.*—This fine species is remarkable for its beautifully furnished ribs, which are so thickly set with arched scales, as almost to cause them to lie over each other.

De Gregorio believes this to be a variety of *alticostata.* Dall and Cossmann, however, regard the two distinct. So far as the Claiborne specimens are concerned, there is little reason for uniting the two, though, that they belong to the same stock of the genus cannot be denied, and when traced back into the St. Maurice stages great difficulty often arises in endeavoring to separate the ancestral forms of the two.

To begin with, there are two varieties of *rotunda* in the Claiborne ''sand''. One with its ribs bedecked with ''arched scales'', the one Lea had in mind in describing the species, reminding one of a series of minute, inverted funnels, or perhaps a dead branch bedecked with a series of saucer-shape fungi, hence we suggest for it the varietal name *fungina* (pl. 28, figs. 4,5). The second, slightly more abundant and growing at times a little larger than the first, is practically the type Lea figures in his Contributions to Geology. The ribs are ornamented by simple nodules, giving a more cord-like aspect, hence the varietal name *funiculus* (pl. 28, figs. 6, 7).

In such a regular form as this, one can scarcely speak of an umbonal ridge, but, in the general region from beak to posterobasal margin there is a tendency to somewhat suppress costal ornamentation. Two or three ribs beneath the ligament margin show rather exaggerated ornamentation (pl. 29, fig. 5). In the medial portion of the shell the ribs show more or less clearly that they rest on a broader, basal ribbing, i. e. shows terrace structure.

In differentiating this species from *alticostata*, it will be noticed that *rotunda* has in general a more nearly circular outline ; there is less of a post-umbonal flattening ; there are but two or three rather conspicuous costæ below the ligamental margin, whereas in *alticostata* there are four and the fourth is oftentimes strongest of all ; the ornamentation or serration is much finer than in *alticostata* and the terracing of the ribs is shown, if at all, medially and not most strongly towards the anterio-submargin as in *alticostata*. The hinge teeth are comparatively thick and robust in *rotunda*. However, there are a few specimens one finds in sorting over hundreds of *rotunda* that show a tendency toward a quadrate form and have the costal serration approaching that of *alticostata*. But the strong fourth rib below the ligamental margin is lacking, likewise the strong terracing anteriorly.

*Types.*—Probably No. 5267, of the Phila. Acad. Coll. was the specimen from which Lea's figure was drawn ; features used in the description of the species were doubtless derived from Nos. 5268-70. Types of the varieties *fungina* and *funiculus* are in the Paleont. Museum at Cornell.

*Horizon.*—Claibornian and Jacksonian stages.

*Localities.*—Texas : Smithville, Bastrop Co. ; Burleson Shell Bluff, Brazas Kiver ; 3 miles N. F. of Alto, Cherokee Co. ; Hurricane Bayou, Marsters and Hodge headright, Houston Co. Miss. : Wautubbee. Alabama : Claiborne "sand", Claiborne.

**Venericardia rotunda**, var. **flabellum**, n. var. Pl. 29. Fig. 8.

General appearance as figured ; beaks more pointed than in *rotunda*, *s. s.* ; ribs about 21, ornamented by broad, blunt nodules and rarely showing in adult stage lateral terracing.

This is a very abundant type at Smithville, Tex.

**Venericardia** (**rotunda**) varying toward **trapaquara**, Pl. 29. Figs. 6, 7.

A small form with inflated umbonal region, a tendency toward a squarish outline and with ribs showing about as much lateral terracing as *rotunda* and with crenulation intermediate in character between *fungina* and *funiculus* ; an immediate descendant of the Woods Bluff form and the progenator of *rotunda*, *carsonensis* &c. Wautubbee and Johnson's Place, Miss.

**Venericardia** (**rotunda** ?) var. **coloradonis**, Pl. 29. Fig. 9.

A form occurring at Smithville, Tex., among *flabellum*, decidedly inflated centrally, having a *wilcoxensis*-like appearance, with ribs laterally terraced and crenules somewhat cup-shaped but comparatively far apart. Also found on the Sabine, La. side 200 yds below the mouth of Bayou Negreet.

**Venericardia trapaquara** Harris, Pl. 30. Figs. 6-9.

*V. trapaquara* Harris, Proc. Phila. Acad. Nat. Sci. 1895, p. 48, pl. 1, fig. 7.

*Harris's original description.*—General form as figured ; ribs about twenty-four, compound, *i. e.*, broad at base, surmounted by a medial dentate carina ; umbonal ridge prominent.

This species is remarkable for its quadrangular form and the prominence of the umbonal ridge. It belongs to the *alticostata* stock and is most nearly allied to *Cardita subquadrata* Con. (Jr. Acad. Nat. Sci. Phila. 2d Ser.,1848, p. 128, pl. 14, fig. 10), but from Conrad's description and figure it is evident that his species is much more compressed, the umbonal region less prominent, and the beaks more nearly central.

*Locality.*—Cedar Creek, southwest corner of Wheelock League, 200 yds. north of Brazos Co. line, Robertson Co., Tex.

*Geological horizon.*—Lower Claiborne Eocene.

*Type.*—Texas State Museum.

A photograph of the specimen described over twenty years ago is given herewith, fig. 8. It is considerably eroded and the true character of the surface markings scarcely determinable from the type. From other localities, for example Clear Lake, La., specimens of the same quadrate form with short ligamental margin appear with others like those shown in figs. 6 and 7, pl. 30. It is clear from occasional well-ornamented specimens that the ribbing though usually showing terracing but faintly, may show it distinctly in places with the crenulation approaching that of the Sabine "*alticostata*". The shell, however, is not so inflated as in that species, and the generally well-defined umbonal ridge and the postero-basal angle give the shell a very different appearance from the somewhat *Verticordia*-like Sabine form.

*Type.*—No 256 in the Texas State Univ., Austin, Tex. Additional specimens figured, pl. 30, figs. 6, 7, 9 in Paleont. Mus. C. U.

*Horizon.*—St. Maurice Eocene.

*Localities.*—Cedar Cr., Tex. ; Clear Lake, La. ; Wautubbee, Miss.

Although the more elongate and quadrangular forms of this species indicate a relationship with *alticostata*, the more circular approach variations of *rotunda*.

**Venericardia natchitoches**, n. sp., Pl. 30. Figs. 10, 13-16.

*Specific characterization.*—Size and general appearance as indicated by the figures and explanations ; substance of the shell rather thick ; ribs low and broad at base, wider than the interspaces, but with a narrow, sharp, serrated median keel, decidedly *alticostata*- like, but only 14 or 15 in number ; sub-ligamental ribs not noticeably larger than those on the remaining portion of the shell. A compact, moderate-sized species generally so broken as to appear more elongate than it should, and with carinal serration eroded away.

*Type.*—From Natchitoches, La., deposited in Paleont. Mus. Cornell Univ.

*Horizon.*—St. Maurice Eocene.

It would seem quite probable that this is the form from which *alticostata* was derived, though the number of costæ is surprisingly small.

**Venericardia alticostata** Pl. 30. Figs. 1-5.

For original description, synonymy &c, see these Bulletins, vol. 1, p. 171 ; vol. 2, p. 247. Other references to closely allied forms or mere varieties of this species may here be added :

*V. blandingi* Con., Jr. Phila. Acad. Nat. Sci., vol. 6, '30, p. 229, pl. 9, fig. 20.

? *V. bilineata*, ditto, vol. 1, '48, p. 128, pl. 14, fig. 9.

? *V. subquadrata*, ditto, p. 128, pl. 14; fig. 10.

*V. transversa* var. *secans* de Greg., Mon. Faun. Eoc. Ala., '92, p. 212.

*V. greggiana* Dall, Trans. Wag. III, '03, p. 1425.
*V. wilcoxensis* Dall, ditto, p. 1426, pl. 54, fig. 12.

If we admit that this stock of *Venericardia* had in Midway times a similar inherent potentiality for differentiation that the *plantcosta* stock had, or that as it ascended through the various Eocene stages it was subjected to similar modifications in environment, then, this being a somewhat more highly organized form with greater details of ribbing and less regularity in outline would naturally sooner evolve variations conspicuous enough to be seized upon by authors as constituting "distinct species". Hence the tendency towards listing "varieties" under *planicosta* and "species" under the *alticostata*-like forms.

The name *alticostata* was first applied to the good-sized, abundant and rather specialized type of the stock found in the Claiborne "sand" at Claiborne. Here it is by far the most conspicuous member of the genus. Moreover, it is sufficiently variable to have caused Lea to separate it into two distinct species, *transversa* and *sillimani*, and to cause de Gregorio to institute a new variety, *secans*. In the red clays in the Orangeburg District of South Carolina, where there is often a commingling of St. Maurice and Claiborne species *alticostata* is present in nearly its usual size, but seemingly with less variation. Our collections from the St. Maurice beds from Alabama westward show no typically developed specimens.

The general characteristics of *alticostata* need not be restated here. However, attention may perhaps be directed to a few interesting features.

When young the shell appears somewhat thin and shows within, the position of the external costæ. The latter are simple or non-terraced, but are ornamented with little knobs or crenules which become long, conspicuous, hollow and irregularly located on the post-umbonal slope. In the adult the ribs appear as follows : Beginning anteriorly, 1-4, crenulate, simple ; 4 or 5 to 12-15, terraced, crenulate, crenulæ becoming funnel-shaped, or as in *fungina*, at the anterio-basal margin ; 12-15 to 17-21, crenulation becoming obsolete, terraces becoming sloping and obsolete, hence interspaces becoming V-shaped ; tip of V somewhat truncated, largely so in Midway forms called *wilcoxensis* by Dall ; slopes of V showing irregularly directed growth-lines which more or less criss-cross at the bottom of the V, also showing most beautifully under a strong lens a fine granulation with a tendency toward a radiate arrangement (pl. 30, fig. 12); from about ribs 24 to 25, or those from the umbonal ridge to about the fourth below the ligamental margin the strength of the ribbing decreases ; from about the fourth below the ligamental margin to the margin itself the ribs become strong again, oftentimes the fourth being the strongest and where it terminates on the posterior margin a slight angle appears ; these sub-ligamental ribs are also more strongly and irregularly ornamented than those below.

*Type.*—Phila. Acad. Nat. Sci.

*Horizon.*—Claiborne and St. Maurice of S. C.

*Specimens figured.*—Paleont. Mus., Cornell Univ.

*Localities.*—Claiborne sand bed, Claiborne, Ala. 3 and 6 miles W. N. W. of Orangeburg, S. C.

**Venericardia complexicosta** Aldrich and Meyer, Pl. 31. Fig. 5.

*V. complexicosta* Ald. and Mr., Jr. Cinn. Soc. Nat. Hist., vol. 9, pt. II, p. 45, pl. 2, fig. 21, a.

*Original characterization.*—Rather small. Cordate. Very much inflated. Beak large. Covered by compound, elevated ribs, crenulated near the umbo. They consist of a large median and two small side-ribs. Margin crenulated within, in correspondence with the outer ribs.

Wautubbee.

*Venericardia mooreana* Gabb, from Texas, and *Ven. perantiqua* Con. (*V. subquadrata* Gabb), from New Jersey have similar ribs, but are less inflated ; have a rounded ventral margin and a smaller beak.

In our collections from Waubtubbee we have found nothing corresponding to this description. But it is clear that we have in this species a direct descendant of the small Woods Bluff Venericardias heretofore commonly referred to a variety of *alticostata*.

### *Remarks on the rotunda-alticostata stock*

In specimens from Woods Bluff (pl. 31, figs. 1-4), note the general terracing of the ribs as in *natchitoches* and *alticostata* ; the tendency toward an angular outline as in *trapaquara*, *carsonensis* and *alticostata* ; and finally, the general shortness of the shell as in *carsonensis* and *rotunda*, with the ribs ornamented by the funnel-shaped nodules so well shown in the *fungina* variety of *rotunda.*

The in-curving of the pronounced beak and the lack of development in the postero-basal region give this form a slight *Verticordia*-like aspect. On passing into the St. Maurice stage this often becomes more quadrangular, less inflated, and above all seems to lose nearly all the terrace structure of the ribs in the multicostate specimens.

*Table showing rotunda-alticostata relationship*

| | | | | |
|---|---|---|---|---|
| **Jackson** | (*præcisa tetrica carsonensis*) | | *eutawcolens* | |
| **Claiborne** | (*fungina rotunda funiculus*) | | *alticostata* | |
| **St. Maurice** | *flabellum* | *coloradonis*<br>*complexicosta* | *alticostata*<br>*trapaquara* | *natchitoches*<br>*perantiqua* |
| **Sabine** | "*alticostata ?* var."<br>*greggiana* | | | |
| **Midway** | *wilcoxensis* | | | |

*Ill-defined and unrecognizable species of Venericardia described by Conrad.*

Proc. Phila. Acad. Nat. Sci., 1847, p. 297. From Eocene Rocks, St. Matthew's Parish, Orangeburg District, S. C.

*Cardita carolinensis*

Suborbicular? profoundly ventricose, with about thirty very prominent square radii, on the anterior side sharp, recurved and crenulated; lunule very broad and cordate, deeply impressed; hinge thick; pit anterior to the cardinal tooth small and profound. This is a fragment of the right valve about 5-8ths of an inch long.

*Cardita bilineata* (see pl. 31, fig. 8)

(Fig'd, Jr. Phila. Acad., vol. 1, pl. 13, fig. 9.)

Subrhomboidal, very inequilateral, with about twenty-four wide, flattened radii, with very narrow interstices, a carina in the middle of each rib, with an impressed line on each side of it; ribs crenulated anteriorly; carina somewhat tuberculated on the posterior side of the shell. Length ¾, height 9-16.

*Cardita subquadrata* (see pl. 31, fig. 7.)

Trapezoidal, compressed; valves flattened in the middle; radii about twenty-five, broad on the disk, with very narrow interstices, and each rib with a crenulated carina in the middle; posterior to umbonal slope the ribs are smooth, not carinated; anterior short, rounded at the end; posterior margin obliquely truncated. Length 5-16. Height 7-20.

*Cardita subrotunda* (see pl. 31, fig. 9)

(Fig'd, Jr. Phila. Acad. vol. 1, pl. 14, fig. 11.)

Orbicular, inequilateral, ventricose, with about twenty-eight rounded prominent, narrow radii; ligament margin very oblique, short; ends obtusely rounded; inner margin slightly crenulated. Length ⅓. Height ⅓.

*Cardita vigintinaria* (see pl. 31, fig. 10)

(Fig'd, Jr. Phila. Acad., vol. 1, pl. 14, fig. 12.

Suborbicular, inequilateral, ventricose, with about thirty square radii, about as wide as the interstices; umbonial slope rounded; anterior margin subtruncated. Length ⅞. Height ⅞.

*To these may be added blandingi of Conrad and inflatior of Meyer*

*Venericardia blandingi* (see pl. 31, fig. 11, a)

(Con., Jr. Phila. Acad. Nat. Sci., vol. 6, 1830, p. 229, pl. 9, fig. 20.)

Shell suborbicular; ribs about twenty, rather square with a rough tuberculated carina on each; anterior margin slightly truncated.

This shell is very like Sowerby's *V. carinata*, but it is smaller, and the carinæ are not smooth; it has been imbedded in a hard silicious matrix, and the carinæ are worn, except near the margin, where they are distinct.

I am indebted to Mr. Morton for this fossil; it was sent to him by Dr. Blanding, of Camden, S. C., who found it at Vance's Ferry in that state, where other shells occur characteristic of the Maryland Upper Marine formation. Cabinet of the Academy.

The specimen is still in the Academy's Collection and is a small *alticostata*-like form with the median portion of the rib thin, or highly keeled. We suppose this to represent the St. Maurice horizon.

**Venericardia inflatior** Meyer, Pl. 31. Fig. 6.

*V. inflatior* Meyer, Amer. Jour. Sci., vol. 29, 1885, p. 460.
*V. inflatior* Meyer, Bull. 1, Geol. Surv. Ala., 1886, p. 84, pl. 1, fig. 26.
*Cardita parva* Cossmann, Notes Compl. &c., 1893, p. 14.

*Meyer's original description.*—Small ; cordate ; ventricose ; subequilateral ; margin semicircular ; beaks elevated and large, turned anteriorly ; surface covered with about twenty ribs ; they are smooth at the umbo, slightly crenulated towards the ventral margin ; the interstices are about of the same size as the ribs ; margin crenulated.

*Locality.*—Claiborne, Ala.

Differs from *Venericardia parva* Lea, from the same locality principally in being smaller, more ventricose and rounded, and having a much larger beak.

We have found nothing in our collections corresponding to this. Its appearance is more or less pathologic.

**Venericardia (Pleuromeris) tortidens**, n. sp., Pl. 31. Figs. 12 a, b.

*Specific characterization.*—Form and size as indicated by the illustrations and explanation ; substance of the shell rather thin, showing within clearly the position of the ribs ; exterior with 14-15 beaded ribs about ⅓ the width of the interspaces ; ribs not terraced laterally, but becoming broader at base and having a width more than equal to the width of the deepest portion of the interspaces ; lunule comparatively large and prominent, muscular scars very faint, hinge in the left valve with a small, forward-downward sloping cardinal, with traces of a lateral at the distal end of the lunular mass, a long posterior extending ¾ way to the posterior end of the shell ; right valve with an anterior socket ⅔ way toward the anterior end of the shell, one small and one large cardinal with a posterior lateral forming a continuation of the ligamental support.

The general appearance of this shell is similar to the young of *V. planicosta*, but the ribs are very few in number, show no signs of terracing, and the teeth are not in accord with those of the young of *planicosta*. Especially peculiar is the anterior cardinal in the left valve, which is not triangular, with a general slope toward the center of the shell, but of a more slender build sloping anteriorly at base. This feature together with the development of laterals make this an interesting form. It differs externally from *parva* by its smaller size, more quadrate form and fewer ribs (scarcely one-half the number of that species).

*Type, etc.*—Paleont. Mus. Cornell Univ.

*Locality.*—Lisbon and Claiborne, Ala. (Very rare).

**Venericardia parva** Lea, Pl. 31. Figs. 13-16.

*V. parva* Lea, Cont. to Geol., 1833, p. 70, pl. 2, fig. 49.
*Cardita* (*Ven.*) *transversa* var. *juvenis* de Greg., Mon. Faun. Eoc. Ala., 1890, pl. 31, figs. 14-22.
*V.* (*Pleuromeris*) *parva* Dall, Trans. Wag., III, 1903, p. 1432.

*Lea's original description.*—Shell subtriangular, rounded below, angular above, inflated, inequilateral, longitudinally and closely ribbed; substance of the shell thick, lunule large, cordate, slightly impressed; beaks elevated, large; ribs about twenty, transversely and thickly crenulate, teeth oblique; cicatrices slightly impressed; cavity of the shell rather deep margin largely crenulate.

Diam. 2, Length .3, Breadth .3 of an inch.

*Type.*—Probably Nos. 5285, 5286 of the Lea Coll., Phila. Acad., though the specimens are somewhat small.

*Horizon.*—Claiborne and St. Maurice.

*Specimens figured.*—Claiborne sand. Paleont. Mus. Cornell Univ.

*Localities.*—Claiborne sand and base of bluff.

"A variety (which may be called *symmetrica*) of this shell occurs both in the Claibornian and Jacksonian, but appears to be very rare. It resembles the ordinary form in every way except that the beaks are erect and central, the dorsal slopes similar and the resulting form of the shell a very regular oval. At first glance this seems very distinct."—Dall. Trans. Wag., III, 1903, p. 1432.

So far we have found no specimens that seem referable to Dall's variety *symmetrica*.

**Lirodiscus smithvillensis** Harris, Pl. 31. Figs. 17-23.

*Astarte smithvillensis* Har., Proc. Phila. Acad. Nat. Sci., 1895, p. 48, pl. 1, figs. 8, a ; 9, a, b, c.

*Harris's original description.*—Size and general form as indicated by the figures ; surface in typical specimens marked by strong concentric rugæ especially toward the base ; these slope gently above but abruptly below, and are superimposed by fine striæ ; umbones flattened.

This species shows great variations in form and size as well as markings. At Collier's ferry some specimens are more elongated, others more rotund ; some have crenulations on the interior submargin while others are smooth. Several of these forms are shown by the figures cited.

*Locality of the typical form.*—Devil's Eye, Colorado River, Bastrop Co. ; Smithville, Bastrop Co., Tex.

*Locality of the smaller forms.*—15 miles southeast of Nacodoches, Nacodoches Co., Tex.

*Geological horizon.*—Lower Claiborne Eocene.

*Type.*—Texas State Museum.

We give herewith photographs of Smithville specimens together with copies of the figures of the smaller Burleson Co. specimens given in the Proceedings of the Phila. Academy.

The specimens photographed are in the Cornell Paleontological Museum.

**Lirodiscus (Crustuloides) psychopterus** Dall, Pl. 32. Fig. 1, a, b.

*Crassatellites (Scambula) psychopterus* Dall, Trans. Wag., III, 1903, p. 1470, pl. 42, figs. 8, 9.

*New subgeneric characterization.*—Shell of moderate size, elliptical, wafer-like in flatness ; smooth on the greater portion of the exterior, but undulating peripherally, especially basally ; lunule and escutcheon linear.

*Type.*—(Of right valve, Paleont, Mus., C. U.), (of left valve, U. S. Nat. Mus.). From Wautubbee, Miss.

*Dall's original description of psychopterus.*—Shell thin, flat, ovate, rounded in front and behind, the anterior end shorter ; surface smooth except for incremental lines and three or four low, distant concentric ridges ; nepionic shell with little or no sculpture ; lunule and escutcheon linear or obsolete ; left valve with two well-marked cardinals, the posterior dorsal margin with a shallow groove for the edge of the opposite valve ; basal margin with a row (in the adult) of minute pustuliform crenations. Long. 20.0, alt. 15.0, semi-diameter 1.3 mm.

The single valve upon which (with a fragment of a larger specimen) this species is founded are undoubtedly young ; the crenations do not appear on their margins, though well-developed on the fragment. It is not the young of any known species and it is highly probable that its remarkable compression is not materially altered in the adult.

The dentition of this species is exactly that of *Lirodiscus* when excessively compressed. The longish, external ligamental groove is well marked in our specimen and apparently so in McConnell's drawing of the same for Dall, as quoted in the synonymy above. It seems within the range of possibility that this may be near the obscure and fragmental *C. palmula* Con (Amer. Jour. Sci., vol. 1, 1846, p. 396, pl. 4, fig. 1.)

*Horizon.*—St. Maurice stage of the Eocene series.

*Localities.*—Wautubbee and Mr. Johnson's place, Miss.

**Lirodiscus protractus** (Meyer), Pl. 32. Figs. 2, a, 3?

*Astarte protracta* Meyer, Bull. 1, Geol. Surv. Ala., 1886, p. 80, pl. 3, figs. 18, 18 a.

*? Lirodiscus protractus* Dall, Trans. Wag., III, 1903, p. 1484, pl. 43, fig. 3.

*Meyer's original description.*—Elongated, subquadrangular, umbonial part strongly flattened ; adductors prominent ; surface covered with distant concentric ribs, becoming obsolete on the umbonial part ; margin entire.

*Locality.*—Enterprise, Miss.

The single specimen was collected by me in the stratum, in Enterprise mentioned Am. Jour. Sci., XXX, p. 70, as upper bed.

So far we have found no recognizable specimens of this species.

The relationship of the Sabine (Woods Bluff) form as herewith shown—fig. 3—to *smithvillensis* or *protractus* is still in an unsettled condition.

**Lirodiscus tellinoides** Con., Pl. 32. Figs. 4-11.

*Astarte tellinoides* Con., Am. Jr. Sci., vol. 23, 1833, p. 342.

*A. nicklinii* Lea, Cont. to Geol., Dec. 1833, p. 61, pl. 2, fig. 35.

*A. sulcata* Lea, Cont. to Geol., 1833, p. 62, pl. 2, fig. 36.

*Lirodiscus tellinoides* Con., Am. Jr. Conch, vol. 5, 1869, p. 47.

*Astarte nicklinii* de Greg., Mon Faun. Eoc. Ala., 1890, p. 199, pl. 27, figs. 6-18.

*Lirodiscus tellinoides* Dall, Trans. Wag., III, '03, p. 1483.

*Conrad's original description.*—Shell oval with concentric sulci; posterior side with a slight groove or fold terminating in a slight emargination of the basal edge; umbo flattened; apex acute but not prominent; muscular impressions a little elevated and very distinct. Length half an inch.

*Locality.*—Claiborne, Ala. *London clay.*

Conrad must have had an immature specimen in hand when he was describing this shell as its usual adult length is not ½ but ⅞ in. De Gregorio figures some young, flat shells as a variety *ebla* but admits that the variety is not very well defined. Lea based his *sulcata* on a shell he described as practically *nicklinii*, minus the peripheral crenulation.

This species shows a remarkably wide range of variation, from somewhat elongate with deep radiating channel to nearly circular with practically no channel. However, the posterobasal margin is always somewhat truncated and the beaks central in comparison with *smithvillensis* from Texas. The general character of surface undulations is quite different in the two species.

*Type.*—Conrad collection, Phila. Acad.

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Locality.*—Claiborne, Ala.

**Astarte triangulatoides**, n. sp., Pl. 32. Fig. 12, a.

*Specific characteriztion.*—Form and size as indicated by the figures and explanation; more broadly ovate and less triangular than *triangulata* Mr.; no flattening of the umbones as in the varietal forms of *smithvillensis*; exterior with regular, symmetrically arranged concentric lines or lirations; margin crenulated within as shown on a second specimen (not the worn type).

This is evidently of the *triangulata* stock but besides the differences between these two species as noted above this is without the excessive lunule excavation of *triangulata* and is only one-half as large. It is double the size of *A. aldrichiana* Har., with less rounded base.

*Type, specimen figured and locality.*—In Paleont. Mus., Cornell Univ., from Lisbon, Ala.

*Horizon.*—St. Maurice Eocene.

**Astarte neuseana**, n. sp., Pl. 32. Fig. 13.

*Specific characterization.*—General appearance high and acuminate as figured ; surface with faint, fine concentric striation and with half a dozen or more broad undulations from the medial portion basally, increasing in strength peripherally ; lunule deep, about half the length of the anterior margin ; escutcheon less sharply defined and slightly less in length.

This is very different from anything else with which we are acquainted in the Eocene of our Southern States. It seems like a rather small, elevated *arata* from the Miocene.

The only specimens we have are in form of imprints in a a porous, silicious limestone from the vicinity of Rocky Landing on the Neuse River, North Carolina.

**Crassinella minor** Lea, Pl. 32. Figs. 14-27.

*Astarte minor* Lea, Cont. to Geol., 1833, p. 63. pl. 2, fig. 38.
*A. minor, parva, fide* Con., Am. Jr. Conch., vol. 1, 1865, p. 9.
*Astarte* (*Micromeris*) *minor* de Greg., Mon. Faun. Eoc. Ala., p. 201, pl. 27, figs. 1-4.
*Crassatellites* (*Crassinella*) *minor* Dall, Trans. Wag., III, 1903, p. 1475, 1480.

*Lea's original description.*—Shell triangular, rounded below, angular above, compressed, inequilateral, concentrically and widely striate ; beaks elevated, pointed ; lunule large, lanceolate ; cardinal teeth small, the posterior furnished with a long, straight lateral tooth ; cicatrices scarcely visible ; margin entire?

Diam. 1-20, Length nearly .1, Breadth nearly .1 of an inch.

The species at first sight might easily be taken for *parva*. The microscope will, however, show very characteristic differences. It is less angular above ; transverse striæ are much farther removed ; it might be said to be sulcate. All the specimens I have (five) are without a crenulated margin. More perfect specimens may, nevertheless, exhibit this character.

*Type.*—This seems to be No. 5225 of the Lea Coll., Phil. Acad. Coll.

*Horizon.*—Claiborne and St. Maurice stages.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

A small variety of this species is found at Alabama Bluff, Trinity River and Elm Creek, Lee Co., Tex.

**Cuna parva** Lea, Pl. 32. Figs. 18, a-e.

*Astarte parva* Lea, Cont. to Geol., 1833, p. 63, pl. 2, fig. 37.

*Crassatellites* (*Cuna*) *parva* Dall, *partim*, Trans. Wag. III, 1903, p. 1480.

*Lea's original description.*—Shell triangular, rounded below, acutely angular above, compressed, equilateral, concentrically and closely striate; beaks elevated, pointed; lunule large, lanceolate; cardinal teeth small, the posterior margin furnished with a long straight lateral one; cicatrices scarcely visible; margin crenulate.

Diam....... Length .1, Breadth .1 of an inch.

The species above described is more elevated and more acutely angular at the beaks than the others. Its striæ are much finer, and it is supposed to be emarginate immediately under the point of the beaks.

The type of the left valve of a species is in the Museum of the Phila. Academy of Natural Sciences, Lea Memorial Coll. No. 5223. The right seems to be lost.

Our figures are of specimens from the Claiborne sand at Claiborne, Ala. Paleont. Mus. Cornell Univ.

**Cuna** var. **subparva** Meyer, Pl. 32. Fig. 19.

*Astarte* (*Micromeris*) *subparva* Mr., Special Excerpt, Senckenberg. Natur. Gesellsch. in Frankfurt a. M., 1887, p. 11, pl. 2, fig. 5.

Regarded by Dall and Cossmann as var. of *parva.*

*Meyer's original description* (translated).—Small, pointed-triangular. Scarcely convex but not compressed. Left valve with a triangular cardinal and a margin-like posterior lateral tooth. The cardinal teeth of the right valve are divergent, unequal, the anterior weakly developed. Muscular impressions oval. Pallial line entire. Exterior surface with strong concentric ribbing. Lunule large, smooth, tongue-shaped. Inner margin dentate. Claiborne, Ala.

In form, size and dentition of the margin the species resembles *Micromeris minutissima* Lea, which, however, is distinguishable at first glance by its radial ribbing. The species is similar to *Micromeris minor* as regards its concentric ribbing; however. *M. subparva* is smaller, narrower, more convex, and has a dentate margin. *Micromeris parva*, occurring likewise at Claiborne with the two species just mentioned, is certainly generally quite different in appearance, on an average rather broader, flatter and larger; yet these relations vary so that they form no sharply defined distinction. However, according to my material, the ribbing is so marked and constant that I have been led to separate the two as closely allied species.

From Meyer's description and figure this seems to us rather distinct from *parva* Lea. Its size and form ally it close to our *fimbriata*, yet the exterior markings are totally different.

**Cuna** var. **fimbriata** n. var., Pl. 32. Figs. 20, a.

This variety as figured is long and rather narrow and shows clearly the fimbriate outgrowth of the concentric lines, and definite traces on the exterior of radii, especially towards the ventral margin. It is from the Claiborne sand.

**Cuna? astartoides**, n. sp., Pl. 32. Fig. 21, a.

*Specific characterization.*—Form and size as indicated by the figures and explanations; appearing at first sight like *C. minor*, but more rounded basally, smaller, with less erect umbones and with very strong, but finer concentric striation; appearance in general also approaching *A. triangulatoides*; dentition somewhat as in *C. minor*, but posterior cardinal much more strongly developed and erect, suggesting the dentition of *Astarte*; a thickening of the margin behind the posterior cardinal suggesting a third cardinal (left valve); resilium obscure, but seemingly above the mid-cardinal; with long, straight posterior channel and sharp lateral margin (left valve); margin entire, like *C. minor.*

*Type, etc.*—I have only the one valve, type, from the St. Maurice Eocene at Wautubbee, Miss.

**Cuna monroensis** Meyer, Pl. 32, Figs. 22, 23.

*Astarte monroensis* Meyer, Excerpt from "Senck'bg., Naturf. Gesell. Frankf. a. M. 1897, p. 10, pl. 2, fig. 6.

*Meyer's original description* (translated).—Small, convex, inequilaterally triangular; ventral margin strongly and regularly curved. Right valve with two divergent cardinal teeth and one anterior lateral. The two cardinals of the left valve are very unequal; the one strong, triangular; the other very little, lamelliform, nearly horizontal. Muscular imprints oval. Pallial line entire. Surface covered with strong concentric ribbing. Lunule lancetlike. Inner margin feebly dentate. *Locality.*—Claiborne, Ala., Monroe Co.

We have nothing corresponding to Meyer's description and figure. The difference in length of the anterior and posterior sides is much greater than in *parvus*, its nearest relative. Again the basal margin is remarkably rounding.

**Micromeris minutissima** Lea, Pl. 32. Figs. 24, 25.

*Astarte minutissima* Lea, Cont. to Geol., 1833, p. 64, pl. 2, fig. 39.
*Micromeris minutissima* Con., Smithson Misc. Coll., 1866, p. 5.
*? Micromeris senex* Meyer, Bull. 1, Geol. Surv. Ala., 1886, p. 81, pl. 3, fig. 22.
*Crassatellites* (*Micromeris*) *minutissima* Dall, Trans. Wag., III, 1903, p. 1480.

*Lea's original description.*—Shell scaleniform, acutely angular above, rather compressed, oblique, ribbed longitudinally; beaks elevated, pointed; lunule very large, cordate; cardinal teeth small, the posterior margin furnished with a long straight lateral one; cicatrices scarcely visible; margin largely crenate.

Diam......... Length 1-20th, Breadth 1-20th of an inch.

*Type.*—Phila. Acad. Nat. Sci., No. 5231. Regarding this type I find in my notes: "Evidently the type of the right valve figured, though the small figure given is too large and the large figure has too many ribs. This has but twelve".

The specimen in our collection figured herewith (pl. 33, figs. 24-25) is also comparatively few ribbed, likewise Meyer's *senex*, referred to above. Meyer gives a very poor figure of his speciman and describes it as follows: "Shell solid, anterior margin straight, posterior margin curved; surface, except the umbo, covered with coarse, radiating ribs". Claiborne bed "G". However this would appear to be from a basal Jackson bed.

**Pleuromeris aldrichi,** n. sp., Pl. 32. Figs. 26-29.

*Specific characterization.*—Shell very minute and rather rotund as indicated by the figures; substance of the shell not thick, smooth and glossy within; exteriorly showing 11 or 12 very well defined strong ribs except on the apical region where there are rather well defined concentric markings; posterior, subligamental margin, as in some sections of the *Veneridæ* with well-raised flanges cutting across the concentric lines at an oblique angle; interiorly, showing position of ribs and very faint muscular scars; lunule and escutcheon both somewhat pouting not far below the apex; ligament scarcely showing above the margins of the shell;

teeth—two cardinals in the left valve, one in the right, an anterior lateral shallow socket in the right, a posterior in the left.

It appears that the large cardinal tooth in the right valve does not fill all the space between the two of the left, especially just beneath the apex, and we are inclined to believe a trace of a resilium may be present.

*Type, specimens figured, etc.*—Paleont. Museum, Cornell Univ.; from the Claiborne sand beds, Claiborne, Ala.

**Crassatellites trapaquarus** Harris, Pl. 33. Figs. 1-5.

*Crassatella trapaquara* Har., Proc. Phila. Acad. Nat. Sci., 1895, p. 49, pl. 2, fig. 3, a.

*Harris' original description.*—General form as figured, surface concentrically striate anteriorly, smooth posteriorly except a few, shallow concentric depressions marking periods of growth; hinge teeth not so strong as in *texalta*; lunular margin concave; basal margin of the valves but slightly convex, crenulated within anteriorly and basally but not posteriorly.

This seems to be the direct descendant of *halei*—of the Sabine but shows a much broader posterior rectilinear margin, sharply defined concentric markings on the anterior and crenulations about the margin as described above. The species *halei* is somewhat intermediate between *tumidula* and *trapaquara*. The beaks for about ten millimeters are sharply and beautifully grooved concentrically, but even here this marking fails completely behind the umbonal ridge. The erect, nearly central umbones of this species distinguish it at once from the oblique semiovate *antestriata*.

*Type.*—Paleont. Mus. Cornell Univ., from Smithville, Tex.

*Horizon.*—St. Maurice.

*Specimens figured.*—Paleont. Mus. Cornell Univ., Tex. and Lisbon.

*Localities.*—Smithville, 8 miles E. of Alto, Elm Cr., northern boundary Murchison's headright, N. E. of Weache's, Houston Co., Texas; Moore's Iron Mine, "Marble Quarry" and Fillmore 2 miles W. of Houghton, La.; Chickasawhay River and Graveyard Bridge near Enterprise, and Johnson's Place, Miss.; Lisbon and Coffeeville (compressed form), Ala. One specimen from Lisbon shows concentric ribbing nearly over the whole valve.

**Crassatellites negreetensis**, n. sp., Pl. 33. Figs. 6-8.

*Specific characteriztion.*—Shell squarish, as figured; when young having very much the appearance of the young of *alta*, but with concentric lirations less far apart; becoming in half-grown specimens, very much of the shape and appearance of the rather uncommon variety of *trapaquara* that has strong concentric lirations over the whole surface; remaining squarish in form till adult stage, not being contracted posteriorly as in *trapaquara*; concentric lirations generally covering the whole surface of the shell, but occasionally becoming more or less smooth basally (see fig. 8).

This is a short form with strong concentric marking showing as clearly on the post-umbonal slope as on the face of the shell. Its ligamental margin, even in adult specimens, remains more or less parallel to the basal margin. This is very different from *trapaquara* as will be seen by noting the sloping ligamental margin shown by figures 1 and 3. Nevertheless as there is considerable variation to be seen in *trapaquara* in specimens from Lisbon, Ala., to Smithville, Tex., we predict *negreetensis* will approach closely to some of these forms.

*Types.*—Deposited in Paleont. Mus. Cornell Univ.

*Horizon.*—St. Maurice Eocene.

*Locality.*—Sabine River, La. side, 200 yds. below the mouth of Negreet Bayou. Veatch Coll.

Casts in material from Eutaw Springs, S. C., indicate the presence of a species very closely akin to *negreetensis*.

**Crassatellites texanus** Heilprin, Pl. 34. Fig. 1.

*Crassatella texana* Heilp., Proc. Phila. Acad. Nat. Sci., 1890, p. 407, pl. 11, fig. 6,

*Crassatella texana* Har., *Idem*, 1895, p. 50, pl. 2, fig. 1.

*Heilprin's original description.*—Shell irregularly rhomboidal; valves prominently angulated posteriorly, with the post-umbonal slope broad and slightly concave; umbones prominent, well incurved; hinge powerful ; exterior surface ornamented with strong and closely set lines of growth, which transverse the entire shell, becoming, however, less prominent on the umbonal slope.

Length of the shell about an inch and a quarter, slightly exceeding the height.

We have already remarked in the Academy's Proceedings : "This is certainly very distinct from *antestriata*. Besides the points of difference mentioned by Heilprin the following may be noted : The umbonal ridge is much sharper in *texana*, and there is a trace of a sinus just below it ; the posterior margin is not subbiangular as in *antestriata*, and the valves are less oblique."

"From *trapaquara* this species can be distinguished by its surface markings, lower form, and the depression just below the umbonal ridge."

*Type.*—Apparently lost.

*Horizon.*—St. Maurice Eocene.

*Specimen figured.*—Tex. State Museum (Univ.).

*Localities.*—Near McBee's schoolhouse, 2 miles E. of Alto, Cherokee Co. and Berryman's land, all in Cherokee Co. ; Murchison's Headright and Lively's Place, Houston Co., Tex. ; H. Johnson's Place, Miss. Casts and imprints of what may be a variety of this species are found at Eutaw Springs and Vance's Ferry, S. C.

**Crassatellites antestriatus** Gabb, Pl. 34. Figs. 2, 3.

*Crassatella antestriata* Gabb, Jr. Phila. Acad., Nat. Sci., vol. 4, 1860, p. 388, pl. 67, fig. 53.

*Crassatella antestriata* Har., Proc. Phila. Acad. Nat. Sci., 1895, p. 49, pl. 1, fig. 10, 10, a.

*Gabb's original description.*—Subquadrate ; beaks very small ; umbonal slope wide, umbonal ridge rounded ; anterior margin semicircular ; basal regularly arcuate, posterior sub-biangular ; surface marked by numerous, large, transverse folds, which commence at the anterior margin, but disappear before reaching the middle of the shell, leaving the rest almost perfectly smooth, (this is not the result of attrition); interior margin very delicately crenate, anterior muscular impression semilunar, posterior subquadrate.

Dimensions.—Length .5 in., width .6 in.

As was noted in our Phila. Acad. article "Gabb's figure and description were of a young specimen ; the figure herewith given is of an adult. Compared with *trapaquara*, *antestriata* is much more oblique, or inequilateral, the posterior extremity is subbiangular and crenate within, and the basal margin is more convex. Externally *antestriata* is more strongly marked''.

*Type.*—Coll. Phila. Acad. From Lee Co., Tex.

*Horizon.*—St. Maurice Eocene.

*Specimen figured.*—Singley's collection, Lee Co., Tex.

*Locality.*—Elm Creek, between Evergreen and Orrell's crossing, Lee Co.; Alabama Bluff, Trinity River; 5 miles W. of Crockett; Hurricane Bayou; Baptizing Creek, Cherokee Co.

**Crassatellites rhomboideus** Conrad, Pl. 34. Fig. 4.

*Crassatella rhomboidea* Con., Am. Jr. Sci., vol. 1, 1846, p. 396, pl. 3, fig. 5.

Oblong, rhomboidal; anterior margin obliquely subtruncated at base; posterior margin obliquely and widely truncated, the inferior extremity rounded; posterior dorsal margin not very oblique; basal margin slightly curved.

Orangeburg, S. C.

Dall refers (Trans. Wag. III, p. 1469) to "*C. rhomboideus* Conrad, 1865 (not of d'Archiac, 1840)" as being an "ill-defined or doubtful Eocene" form.

We do not understand why Dall gives this late date for Conrad's species but quite agree with him in considering it a doubtful form. From its general shape we strongly suspect Conrad had a Miocene cast in hand when describing this "species".

### *Crassatellites protexta stock*

This long type of *Crassatellites* is particularly characteristic of the upper half of the Eocene of the Gulf States. In the Virginia basin, during the Sabine age, the drawn-out *alæformis* type with its beautifully undulating exterior flourished everywhere. In the St. Maurice of the Gulf States the *protexta*-like forms appeared abundantly to the east of the Mississippi; only rarely, so far west as the Rio Grande. In the Claibornian at Claiborne it appears to us that a representative of the most primitive form of this stock is preserved. From some form like this it would seem that the St. Maurice representatives were early derived. In the Jackson we find, strangely enough, as in the case of *Venericardia rotunda*, species or varieties, according to the taste of the investigator, more nearly related to the St. Maurice than to the Claiborne representatives. Such being the case it would seem that the whole *protexta* stock could well be referred to one and the same species while a number of names could be used to designate forms that have a somewhat important stratigraphic or geographic significance,—constantly bearing in mind, however, that these forms occasionally imperceptibly intergrade. But for the present, in order not to disturb the old nomenclature any more than is absolutely necessary, we will treat of the *protexta* stock under three ''species'', corresponding with the forms found in the St. Maurice, Claiborne and Jackson stages respectively and then indicate such varietal forms as seem worthy of consideration. The general scheme of relationships may be represented thus:

**Jackson** *flexurus*
var. *flexurus*, *productus*, *postclarkensis*
**Claiborne** *protextus*
**St. Maurice** var. *ludovicianus* *clarkensis* *ferrocarolinus*
*clarkensis*

**Crassatellites clarkensis** Dall, Pl. 34. Figs. 5-10.

*C. clarkensis* Dall, Trans. Wag., III, 1900, pl. 36, fig. 20, 21, 24, 25.
*C. clarkensis* Dall, *idem*, 1903, p. 1470.

*Dall's original description.*—Shell solid, elongated, moderately thick, inequilateral, the anterior end shorter, nearly equivalve; anterior end rounded, posterior end obliquely descending, pointed and subrostrate, with a marked carina from the umbo to the posterior angle; lunule and escutcheon subequal, lanceolate impressed; surface smooth except for incremental rugæ and microscopic radial striation; nepionic shell small with about six sharp, low, concentric ridges which cease abruptly in less than three millimeters from the apex; hinge well developed; scars of ligament and resilium of moderate size; third right (posterior) cardinal nearly intact and distinct; anterior and basal margin sharply, finely crenate, the subsurface layer of the shell weathering out with distinct ribs corresponding to crenations. Lon. 42.5, alt. 26.5, diam. 19.0 mm.

This resembles *C. protextus*, from which it is easily separable by its more pointed rostrum, sinuate below, and the very small space occupied by the nepionic sculpture, which in *C. protextus* extends over a radius on the disk of some eight or ten millimeters. The latter also has more conspicuous radial striation and coarser crenulations.

Eocene of Wautubbee hills, Clark County, Mississippi, Burns; near Saline Bayou, St. Maurice, Louisiana, Vaughan; and at Claiborne, Alabama, L. C. Johnson.

At the localities designated above by Dall one finds a great variation in form, size and surface markings in this type of *Crassatellites*. The short, smooth forms with rather marked carina and few umbonal undulations as indicated by Dall's figures may be called *clarkensis*, *s. s.* They are common at St. Maurice, La. With these at St. Maurice and near Enterprise, Miss., are similar forms with rather fine and extensively displayed concentric marking; these may receive the varietal name of *ludovicianus*. Again, to the east in Alabama and especially in South Carolina the ''nepionic concentric ridges'' of *clarkensis* are extended over considerable of the umbonal area as shown by pl. 34, fig. 7 and the ''marked carina'' may become less obvious as in fig. 9 of the same plate. Here, too, the posterior may or may not be ''pointed''. These long specimens, showing oftentimes so much umbonal liration and giving almost a hint at a distant relationship with *alæformis*, may receive the varietal name of *ferrocarolinus*.

*Type of clarkensis.*—U. S. Nat. Mus.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Loclities.*—Rio Grande, 1 mile above Starr-Zapata Co. line, Tex.; 3 miles S. E. of Negreet, St. Maurice, Chautauqua, Robertsville; Cooper's well, Winnfield, La., 1000 ft.; 2½ miles E. of Newton, Wautubbee, 8 miles W. of Enterprise, Miss.; Lisbon, base of bluff at Claiborne, Ala.; 3 miles W. N. W. of Orangeburg, S. C.

**Crassatellites protextus** Con., Pl. 35. Figs. 1-5.

*Crassatella protexta* Con, Foss. Sh. Tert. Form., 1832, p. 22, pl. 8, fig. 2.

*Crassatella protexta* de Greg., Mon Faun. Eoc. Ala., 1890, p. 198, pl. 24, figs. 31-37; pl. 25, figs. 2-11.

*Conrad's original description.*—Elongated; umbonial slope angular and obscurely plicated; the posterior side produced, or rostrated with age, and the extremity obliquely truncated; beaks with concentric grooves; inner margin crenulated.

*Locality.*—Claiborne, Ala. Middle Tertiary.

This fine shell though variable in outline, is distinguished by a length in proportion to its height, unusual in the genus, it is abundant, and a single valve measures 2½ inches in length and 1 inch and 3 tenths in height.

Conrad gives a very good figure of an adult form of this species in 1845 (Amer. Jour. Sci., vol. 1, pl. 2, labelled 1 by mistake) and makes further descriptive remarks regarding the young on p. 396 of the same Journal, illustrating the same by fig. 4, pl. 3. By mistake Conrad numbered a figure of *alæformis* "2" on plate 3, which, according to the text, p. 403 should be numbered "3". This slight error caused de Gregorio in his famous Claiborne work to copy the figure and call it *protexta* (see his pl. 25, fig. 12). Gregorio cites Conrad's work, giving the page correctly, but gives the wrong year, i. e., 1833 instead of 1832. This oversight in dates probably caused him to wonder so much why Lea did not cite the species at all though he (Gregorio) found it so abundantly.

In the very earliest stage of growth this species shows a more or less circular form, with concentric undulations corresponding to those already described under *clarkensis*. But very soon these broader undulatians give place to strong concentric lines that are usually carried over to one-third the distance from beak to base. This is the very same type of ornamentation seen on var. *ludovicianus* just referred to but less extensive. In well-developed *protextus* the ligamental margin appears slightly more concave than in *clarkensis*, the posterior is broader and the slight depression below the umbonal ridge is not so conspicuous, but the swelling just below or anterior to this furrow is much more pronounced in *protextus*. The slight concavity of the ligamental margin has a tendency to give the beak an opisthogyrate aspect. Although there is considerable range in the extent of concentric ornamentation in this species in adult shells no clear-cut varieties based on this feature seem to be differentiable. The general outline of the shell varies greatly as will be seen by referring to the above-mentioned plate and figures. Had we Claiborne fossiliferous outcrops ranging from Texas to the Carolinas it is quite possible and even probable that this species would show variations in shape and markings quite equal to those displayed by the St. Maurice and Jackson species. Were this species older than, instead of younger than the St. Maurice diversified specimens it would be easy to see how the latter could be regarded as simply specialized forms, or derivatives from this, and how the Jackson types are nothing but slightly modified St. Maurice specimens. Here then we have the same peculiarity noted under the *rotunda* stock of *Venericardia*, that often the St. Maurice and Jackson forms seem very much more nearly related than do the Claiborne and Jackson specimens. *Flexurus* is a strikingly strong striate *ludovicianus* with perhaps *texanus* affinities; *productus* is directly derived from *ludovicianus*, and *postclarkensis* is akin to *clarkensis*, *s. s.* with less sinuosity along the post-basal margin. From an ancestral form which seems to be carried along in *protextus*, all these forms have descended.

*Type.*—Phila. Acad. Nat. Sci.

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Localities.*—Claiborne sand, Claiborne, Ala.

**Crassatellites texaltus** Harris, Pl. 36. Fig. 1-3.

*Crassatella texalta* Har., Proc. Phila. Acad. Nat. Sci., 1895, p. 49, pl. 2, fig. 2.

*Harris's original description.*—General form as figured; exterior smooth about the umbones, but marked by lines of growth anteriorly and sub-basally; hinge and marginal crenulation as in *C. alta* Con.

This species is closely allied to *C. alta*, but is distinguished by its proportionally longer form and its smooth umbones, the latter feature being in marked contrast with the corrugations of *C. altus*.

This is a more angular form than *altus* (see pl. 36, figs. 1 and 6) when adult, and lacks the coarse umbonal undulations. It is intermediate between *trapaquara* and *altus*. It has not the obliquity, or the posterior, rounded fullness of *obliquatus* (Mon. U. S. G. S. IX, 1885, p. 235, pls. 29, 30). Again, unless Whitfield's drawings of the hinge are incorrect *obliquatus* cannot be referred to *Crassatellites.*

It is quite probable the specimens that grow to such great size in South Carolina (for example, at Carson's Creek) measuring 140 x 150 mm. may belong to this species and not to *altus.* Certainly the numerous casts along the Neuse River, N. C. are much closer *texaltus* than to *altus.*

*Type.*—Texas State Univ.

*Horizon.*—St. Maurice Eocene.

*Specimen figured.*—The type.

*Localities.*—Hurricane Bayou (Marster and Hodges' headright—the type form), Alabama Bluff, Trinity River ; 2½ miles E. of Newton ; 4 miles W. of Enterprise ; Wautubbee, Miss. ; ? Eutaw Springs, S. C. Seventeen miles above Newbern on the Neuse River, N. C.

**Crassatellites altus** Dall Pl. 35. Fig. 1. Pl. 36. Figs. 4-6.

*Crassatella alta* Con., Foss. Sh. Tert. Form, 1832, p. 21, pl. 7.
*Crassatella alta* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 197, pl. 26, figs. 1-10.

*Conrad's original description.*—Suboval, thick and ponderous, compressed ; anterior margin obtusely rounded ; posterior margin broad and slightly angular ; beaks with regular concentric grooves, and somewhat angulated behind ; inner margin crenulated.

This is one of the finest great bivalves known from our Tertiaries. At Claiborne, specimens measuring 100 mm in height and 100 plus in width or length are not rare.

In considering the smoothness of the beaks of the St. Maurice *texaltus* and the marked "concentric grooves" on the beaks of the Claiborne *altus*, one may perhaps regard the wholly concentrically grooved *willcoxi* of the Wilmington (Jacksonian) as completing this type of ornamentation as shown in this stock.

*Type.*—Phila. Acad.

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Locality.*—Claiborne, Ala.

**Scintilla alabamiensis** Cossman, Pl. 37. Figs. 1, 2.

*S. alabamiensis* Cossmann, Notes Complém. 1893, p. 12, pl. 1, figs. 15, 16.

*Cossmann's original description.*—Testa minuta, fragilis, elliptica, extus lævigata ac depressa, intus subradiata; umbone parum, prominulo, haud incurvo, fere mediano; dentibus anticis valvulæ sinistræ obliquis et divergentibus: fossula profunda: dente postico erecto, brevi; cicatriculis rotundis, minutis, alte sitis.

Petite coquille mince, fragile, elliptique, presque équilatérale, ayant les extrémités arrondies, le bord palléal peu courbé, les deux parties du bord supérieur également déclives de part et d'autre des crochets, qui sont peu saillants, peu courbés, opposés et à peu près médianes.

Surface extérieure lisse, déprimée; surface intérieure obscurément rayonnée. Charnière composée sur la seule valve gauche que je posséde, de deux dents cardinales antérieures, obliques et divergentes, séparées par une fossette large et profondément excavée de la dent latérale postérieure, que est mince, courte bien posée sur le bord où elle fait une saillie très visible.

Impressions musculaires petites, arrondies, placés assez haut.

Dimensions: longueur, 4 mill.; hauteur, 9 mill.

Bien que je n'aie, jamais, recueilli qu'une seule valve un peu entamée de cette rare espèce, je n'hésite pas à la décrire, parce qu'elle presénte bien les caractères du genre *Scintilla* qui n'avait pas encore été signalé dans l'Eocène d'Amérique et qu'elle est bien distincte des espèces du bassin parisien, qui sont allongées ou plus convexes et dont le bord supérieur est davantage paralléle au bord palléal.

*Loc.*—Claiborne, ma coll.

**Sportella gregorioi** Cossman, Pl. 37. Figs. 3, a, b.

*S. gregorioi* Cossm., Notes Complém. 1893, p. 11, pl. 1, figs. 11-12.

*Cossmann's original description.*—Testa depressa, oblonga, fere æquilateralis, latere antico paululum longiore, umbone mediocriter prominulo; cardine bidentato; nympha brevi ac laminari; cicatriculis musculorum angustis et elongatis.

Coquille déprimée, assez petite, à peu près lisse et seulement ornée de stries, d'accroissement tres peu visibles; forme presque équilatérale, coté postérieur un peu puls court et plus élargi, avec une dépression dorsale assez profonde; coté antérieur plus étroit et ovale; crochets faiblement gonflés, médiocrement saillants, en arrière des quels le bord supérieur est un peu dilaté; bord palléal peu curviligne. Charnière composee, sur la valve gauche, d'une dent cardinale antérieure assez saillante, oblique et reliée à la lame cardinale qui est assez longue en avant, d'une dent médiane, courte et petite, fosse du cartilage rétrécie par une échancrure de la lame cardinale sous la pointe du crochet; nymphe lamelleuse et très courte; impressions musculaires étroites et allongées en form de massue.

Dimensions : Longeur, 7.6 mill. ; largeur, 5 mill.
*Loc.*—Claiborne, une seule valve*, ma coll.

**Sportella alabamiensis** Ald., Pl. 37. Fig. 4.

*Lepton ? alabamiensis*, Bull. Am. Pal., vol 2, 1897, p. 182, pl. 6, fig. 9.
*Sportella alabamiensis* Dall, Trans. Wag., III, 1900, p. 1140.

For description of this species, see Aldrich's article referred to in the synonymy.

**Hindsiella faba** Meyer, Pl. 37. Fig. 5.

*H. faba* Meyer, Bull. 1, Geol. Surv. Ala., 1886, p. 82, pl. 1, fig. 25.
*Kellia faba* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 211.
*Hindsiella faba* Dall, Trans. Wag., III, 1900, p. 1136.

*Meyer's original description.*—Shell convex ; sinus of the ventral margin gently rounded; covered with regular lines of growth ; musclar impressions ovately elongated ; an indistinct oblique tooth below the beak (right valve),

*Locality.*—Claiborne, Ala.

Allied to *Hindsiella arcuata* Lam., sp. of the Paris Basin.

**Hindsiella** (**faba** var. ?) **donacia** Dall, Pl. 37. Fig. 6.

*H.* (*faba* var. ?) *donacia* Dall, Trans. Wag., III, 1900, p. 1136, pl. 45, fig. 12.

*Dall's original description.*—Shell small, donaciform, with variable outline, rather compressed, inequilateral, the posterior side shorter, anterior dorsal margin sloping to the rounded anterior end, base slightly insinuated ; posterior dorsal margin with a shorter and steeper slope, the posterior end of the shell subtruncate obliquely, the basal angle rather marked ; the whole shell slightly twisted ; surface with concentric, somewhat irregular incremental lines and microscopic, partly obsolete radial striæ; interior polished, hinge like that of *H. faba* but with the right cardinal more prominent and stem-like, the left cardinal obsolete ; in some specimens the resiliary insertion was directly on the surface of the valve, in others (probably more mature) there was a distinct thickening, especially about the margin of the scar. Long. 2.2, alt. 1.7, diam. 0.6 mm.

This shell is probably distinct from *H. faba*. It is more triangular, more inequilateral and more compressed. The sinuation of the base is much less conspicuous, the cardinal tooth is longer, and the laminæ proportionately shorter than in *H. faba*. Several specimens with the valves in the natural position indicate that there was a small external ligament in addition to the large internal resilium.

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*See Aldrich, Bull. Am. Pal., vol 2, 1897, pl. 6, fig. 4 for the opposite valve. (Fig. 3, b of this report).

*Locality.*—Claiborne, Ala. (sand bed).

**Erycina plicatula** Dall, Pl. 37. Figs. 7, 8.

*E. plicatula* Dall, Trans. Wag.,III, 1900, p. 1143, pl. 44, figs. 7, 12.

*Dall's original description.*—Shell compressed, ovate, inequilateral, the anterior side longer; beaks low, pointed, somewhat prosocœlous; surface near the beaks faintly concentrically striate or smooth; about half-way to the margin from the umbo the sculpture grows stronger, consisting of fine, low, rather sharp plications, not always continuous nor in exact harmony with the incremental lines; anterior dorsal margin depressed in front of the beaks, nearly straight for a short distance, then rounding evenly to the anterior end; base arcuate, posterior end more bluntly rounded, with the posterior dorsal margin arcuate and high, hinge plate narrow, channelled, with a short, obscure anterior lamella, whose "hook" is represented by a small pustular elevation; posterior lamella long, arcuate, almost fused with the margin but rising distally to a small elevation; interior of the valve smooth or with faint radial lines; adductor scars narrow, long, extending well down towards the base. Lon. 9.5, alt. 7, diam. 2.2 mm.

Two left valves of this well-marked species were found in the marl. The other species described from this horizon are much smaller and more inflated, and the young of *E. plicatula*, judging by the incremental lines, had a different outline from either of the others.

Eocene of the Claiborne sands at Claiborne, Ala.

**Erycina whitfieldi** Meyer, Pl. 37. Fig. 9.

*E. whitfieldi* Meyer, Bull. 1, Geol. Surv. Ala., 1886, p. 82, pl. 1, fig. 29.

*Meyer's original description.*—Small; substance of the shell thin, porcellaneously shining; oval; convex; inæquilateral, the anterior side the largest; left valve with two obsolete pyramidal teeth on the anterior side, and on the posterior side a compressed one, which is very small and distant from the beak; surface shining, smooth, except for very fine concentric lines of growth; margin entire.

*Locality.*—Claiborne, Ala.

The nearest species in the Paris Basin seems to be *Erycina obsoleta* Desh.

**Bornia scintillata** Dall, Pl. 37. Fig. 10.

*B. scintillata* Dall, Trans. Wag., III, 1900, p. 1149, pl. 49, fig. 10.

*Dall's original description.*—Shell small, subtrigonal, subequilateral, polished, finely, sharply radially grooved, the grooving of the middle of the disk finer and closer than that towards the ends; the beaks moderately elevated, nearly smooth, the larval shell small, distinct; hinge armature feeble; the left posterior lamina small, feeble, short; anteriorly the "hooks" of the two anterior laminæ distinct, simulating cardinals, the lateral portions nearly obsolete; the grooving of the exterior faintly visible interiorly towards the anterior end but not crenulating the basal margin; muscular impressions narrow, feeble; basal margin entire. Long. 3.75, alt. 3.0, diam. 1.5 mm.

A single left valve of this very distinct species was obtained. From *B. prima* Aldrich, it differs by being grooved, not plicated, in the absence of the punctation which covers the surface in *B. prima*, and in the much more profuse and finer sculpture.

Eocene of the Claiborne sands, Claiborne, Alabama; Burns.

**Bornia plectopygia** Dall, Pl. 37. Fig. 11.

*B. plectopygia* Dall, Trans. Wag., III, 1900, p. 1149, pl. 49, fig. 9.

*Dall's original description.*—Shell small, short, rounded ovate, polished, smooth to the eye, except for incremental lines and about three faint radial plications on the posterior basal half; beaks low, distinct; hinge armature feeble, the distal laminæ obsolete, the hooks of the left anterior laminæ perceptible but not prominent; anterior side short, rounded, posterior side produced downward and backward, the margin indented by the radial furrows, elsewhere entire; scars obscure. Long. 4.5, alt. 4,0, diam. 2.0 mm.

A single left valve of this species was collected which though somewhat imperfect cannot be confounded with either of the other species from this horizon. There is a faint microscopic radial striation on the surface, a sulcus for the ligament, and a faint excavation for the resilium.

Eocene of the Claiborne sands, Ala.; Burns.

**Bornia dalli** Cossman, Pl. 37, Fig. 12, a.

*Montacuta dalli* Cossm., Notes Compl., 1893, p. 12, pl. 1, figs. 13-14.
*Bornia dalli* Dall, Trans. Wag., III, 1900, p. 1149.

*Cossmann's original description.*—Testa minuta subtrigona, valde inæquilateralis, antice duplo longior, postice truncata et subangulosa, margine palliali rectilineari, umbone, parvo, haud prominulo; superfices externa striis fibrosis incrementi ornata, postice angulo decurrente notata, in medio plana, antice obliquiter angulata; cardine bidentato, fossula mediana profunde emarginata; cicatriculis bene impressis, anteriori longe ac anguste producta.

Jolie petite coquille, subtrigone, très inéquilatérale, peu convexe : coté antérieur égal aux deux tiers de la longueur, plus retréci, ovale à son extrémité ; coté postérieur bien plus court, dilaté et un peu tronqué ; bord palléal complètement rectiligne ; crochets petits, à piene saillants et peu gonflés. Surface extérieure ornée de fines stries d'accroissement, fibreuses et serrées ; la région médiane est absolument plate, limitée par deux angles décurrents, dont l'un plus saillant correspond à la troncature anale, l'autre plus faible encadre une depression oblique qui aboutit à l'extrémité antérieure.

Charnière courte et petite, comportant, sur la valve droite, deux dents minuscules entre lesquelles est une large fossette profondément échancrée sous le crochet ; impressions musculaires bien gravées, l'antérieure allongée, étroite, l'autre plus courte et plus arrondie.

Dimensions : longeur, 3.5 mill. ; hauteur, 2.5 mill.

Cette intéressante espèce présente bien les caractêres du genre *Montacuta*, par sa forme, sa charnière et ses impressions musculaires : elle est moins plate et moins mince que notre *M. tenuissima.*

*Loc.* Claiborne, une seule valve, ma coll.

**Bornia isosceles**, n. sp., Pl. 37. Fig, 13, a.

*B. prima* Vaughan, Bull. Geol. Surv. Ga., No. 26, 1911. p. 240.
*B. prima* Cooke, U. S. Geol. Surv., Prof. Pap., 120-C, 1918, p. 51.

*Specific characterization.*—A direct descendant of *B. prima* (these Bulletins, vol. 2, p. 181, pl. 6, fig. 3) from the upper Sabine of Alabama ; having become almost an isosceles triangle in outline with a base of 7.5 and an altitude of 5 mm ; anterior and posterior somewhat more extensively and finely radiate than *prima*, less so than in *scintillata.*

*Type and specimens figured.*—U. S. Nat. Mus.

*Horizon.*—St. Maurice Eocene.

*Locality.*—Sloan's Scarp, on McBean Creek, between McBean Station and Savannah River, Ga.

**Bornia perdita**, n, sp., Pl. 37. Fig. 14, a.

*Specific characteriztion.*—Shell small, elliptical-triangular as figured ; thin ; anterior and posterior marked by fine, bifurcating radial plications, plications showing obscurely also centrally ; concentric markings obsolescent ; internally showing traces of exterior radii ; muscular markings rather faint.

This is more nearly related to Dall's *scintillata* from the Claiborne than Aldrich's *prima* from the Sabine. It was with some St. Maurice material marked "Sabine River ?", La. The other species just mentioned from our Eocene are much wider proportionally than this ; *prima* has much coarser plications, while the "grooving" mentioned by Dall on *scintillata* is much finer.

The figured specimen and type is deposited in the Paleontological Museum, Cornell University.

**Alveinus minutus** Conrad, Pl. 37. Fig. 15.

*Alveinus minuta* Con., Amer. Jr. Conch., vol. 1, 1865, p. 138, pl. 10, fig. 2.

*Alveinus minutus* Meyer, Bull. Geol. Surv. Ala., No. 1, 1886, p. 84, pl. 1, fig. 19.

*Alveinus minutus* Dall, Trans. Wag., 1900, III, p. 1166-67.

*Conrad's original description of Alveinus.*—Equivalved, smooth ; anterior, posterior and ventral margins channelledwithin ; hinge of right valve emarginate under the apex, and having one pyramidal tooth anteriorly ; hinge of left valve with a pit under the apex, and two compressed diverging teeth anteriorly ; pallial line entire ?

Descr., *minutus.*—Suboval or suborbicular, very inequilateral, convex, smooth and shining ; margin rounded.

This is a minute shell, much enlarged in the figure, and common in the small quantity of marl which accompanies the specimens. The family to which it should be referred is undetermined. A microscopic channel margins the valves within.

Meyer claims to have foumd this Jacksonian form in the Claiborne sand and hence we have copied his figure and have here included Conrad's original description, though our collections show no specimens below the Jackson horizon.

**Montacuta claiborniana** Dall, Pl. 37. Fig. 16.

*M. claiborniana* Dall, Trans. Wag., III, 1900, p. 1171, pl. 45, fig. 21.

*Dall's original description.*—Shell small, thin, polished, smooth, nearly equilateral, very slightly arcuate, moderately inflated; beaks low, dorsal margin thin, evenly arcuate, passing distally into the rounded ends, of which the anterior is shorter and less high; base slightly arcuated; in the left valve the posterior dorsal margin above the scar of the internal ligament is somewhat reflected, the single minute cardinal is under the beak with a slight fold extending forward. Long. 1.7, alt. 1.2, diam 1.0 mm.

A single small shell was obtained from Claiborne shell sand. Though doubtless immature, it is described as being the only representative of the genus in this horizon, *M. dalli* Cossman being, under the present arrangement, referred to *Bornia*.

**Lucina dolabra** Conrad, Pl. 37. Figs. 17-21.

*L. dolabra* Con., Am. Jr. Sci., vol. 23, 1833, p. 343.
*Astarte recurva* Lea, Cont. to Geol., 1833, p. 61, pl. 2, fig. 34.
*Lucina recurva* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 202, pl. 27, figs. 36-41.

*Conrad's original description.*—Shell elevated, with distant concentric imbricated and obscure radiating striæ; posterior margin profoundly channelled, beaks prominent and curved forwards; lunule impressed, cordate; inner margin crenulated. Length, half an inch.

*Locality.*—Claiborne, Alab., *London clay.*

*Type.*—The half dozen or more specimens of this species in the Conradian Collection in the Phila. Academy are probably the types Conrad used in describing the species.

*Horizon and locality.*—So far as our collections go this species seems to be confined to the Claiborne sand bed at Claiborne, Ala.

**Lucina amica** de Gregorio, Pl. 37. Figs. 22, 23.

*L. amica* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 204, pl. 28, figs. 1-2.

*De Gregorio's original description.*—Testa parvula, solida, inæquilatera, elliptica-suborbicularis antice et postice extus vix subangulata; lamellis concentricis latis, subimbricatis ornata; in valva dextra dente cardinali potius notato; dentibus lateralibus (antico et postico) notatis; margine crenulato.

Cette espèce est analogue par l'ornementation à *l'Egeria nana* Lea. Elle diffère de la *L. Smithi* Meyer par le défaut de lignes rayonnantes, et par les lamelles concentriques. Elle diffère de la *L. bisculpta* Meyer avec laquelle elle a quelque d'analogie par le épaisseur de la coquille, les lamelles régulières etc. (Coll. mon Cabinet.)

This we regard as some extraneous form that de Gregorio had mixed with his Claiborne matter while working up his "Monograph". Dall seemed inclined at first to regard it as synonymous with *pomilia* (see p. 1364, III, Trans. Wag.) and later suggested its possible relationship to *claibornensis* (see p. 1374, op. cit.) No such form has shown up in any of our Claiborne collections.

**Lucina hamatus** Dall, Pl. 37. Fig. 24.

*Phaicoides* (*Here*) *hamatus* Dall, Trans. Wa6. III, 1903, p. 1364, pl. 50, fig. 9.

*Dall's original description.*—Shell small, plump, with small, high, prosogyrate beaks; dorsal areas strongly emphasized by an impressed sulcus on their ventral margins which terminates distally in an indentation of the margin which, as it were, loops up the line of the profile; surface sculptured with incremental lines and regularly spaced, rather distant, slightly elevated and recurved concentric lamellæ; lunule small, cordate, deep, overshadowed by the gyrate umbones; escutcheon none; anterior end of the valve below the anterior dorsal area projecting, subangular; hinge and adductor scars normal. Height 13.6, length 14.0, diam. 10.0 mm.

Eocene of the lower bed at Claiborne Bluff, Ala.; Lea.

Our various collections from the base of the Bluff have unfortunately brought to light nothing corresponding to this species. The credit of its collection Dall gives to Lea, but, so far as we are aware, none of Lea's fossils were from the basal (St. Maurice) bed. It is within the range of mere possibility that this is a pathologic specimen of *L. claibornensis*, a very common species at this horizon and locality, and with surface markings agreeing well with the characters enumerated above.

### *Various stocks of small Lucinas.*

In taking up the smaller Lucinas of the St. Maurice and

Claiborne stages one notes at once the presence of the new, or non-Sabine form, *L. dolabra*. It has practically no resemblance to anything seen before in the American Eocene deposits.

One marvels at the scarcity of little Lucinas in the vast stretches of St. Maurice deposits of the Gulf border states.

The generally lignitic conditions of the Claiborne stage, however, bring back the bulk of the small Lucinas that had appeared just at the close of the Sabine. For want of better names, the three common stocks may be named the (1) *smithi*, (2) *ulrichi* (Har. non Clark) and the (3) *ozarkana*. These are represented at or near the Sabine—St. Maurice division line in the Virginia basin by (1) *whitei*, (2) *uhleri* and (3) *dartoni*. No. 1 is almost *Corbis*-like, with well developed laterals, with small cordate lunule and well-defined cardinals; No. 2 is less inflated, more finely sculptured, with weaker dentition and longer lunule; No. 3 has its dentition reduced to cardinals, while between the more distant concentric raised lines, the fine radiate lines are conspicuous. No. 3 quickly passes into huge toothless forms in the St. Maurice and dies out as the smaller *subvexa* in the Claiborne. Nos. 1 and 2 seem remarkably poorly represented in the St. Maurice stage. We have a few specimens of No. 1 from the Orangeburg District, S. C., and have seen an imperfect valve of No. 2 from Texas. But in the Claiborne sand one finds such specimens in abundance. The elliptical, miniature *Corbis*-like *smithi* of the upper Sabine (pl. 38, figs. 2-4) becomes more elevated, with more pronouncedly differentiated surface sculpture, passing on the one hand directly from *pomilia* to the elevated, wavy *alveata*, and on the other less directly to the smoother forms with more sharply defined dorsal areas, *carinifera* of Conrad. All these might well be referred to one species if one cared to combine all that seem to show direct relationship. No. 2 of the Sabine, is perhaps represented in the Claiborne by *papyracea*, with its comparatively smooth surface, long lunule, weak dentition, &c. But occasionally startling resemblances occur between some members of this line of descent and some members of the *pomilia* branch. A form from Jackson, Miss., probably the "*curta*" of Conrad although the description and figure given by Conrad of that species leave much to be desired, has a general *pomilia-smithi* appearance but with longer lunule.

**Lucina carinifera** Conrad, Pl. 37. Figs. 25-29.

*L. carinifera* Con., Foss. Sh. Tert. Form., Nov. 1833, p. 40.
*L. cornuta* Lea, Cont. to Geol., Dec. 1833, p. 56, pl. 1, fig. 29.
*L. carinifera* Con., Amer. Jr. Sci., vol. 1, 1846, p. 402, pl. 4, fig. 15.

*Conrad's original description.*—Shell suborbicular, subequilateral ventricose, with equidistant, acute, prominent concentric striæ; anterior side with a profound fold, or obtuse elevation, and a cordate undulated depression; posterior side with a profound indented fold, emarginating the base; anterior end emarginate above the fold; beaks prominent and incurved; cardinal and lateral teeth distinct; cavity capacious; margin crenulated.

We have given copies of both Conrad's and Lea's figures of this species insomuch as both show specimens more acutely pointed anteriorly than any in our collections. The more common appearance of this species is shown by figs. 27-29.

This seems to be a mere off-shoot from the *pomilia* stock described below. The "dorsal areas" are not so sharply defined as in *hamatus* as described by Dall, but are more distinct than in *pomilia*.

*Type.*—The two specimens in the Conradian Collection at the Phila. Academy are doubtless the types. They are from the Claiborne sand bed.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

We have not found this "species" outside of the sand bed at Claiborne.

**Lucina pomilia** var. **smithi** Meyer, Pl. 38. Figs. 1-5.

*Lucina smithi* Meyer, Bull. 1, Geol. Surv. Ala., 1886, p. 81, pl. 1, fig. 23.
*Lucina pomilia* Har., Bull. Am. Pal., '97, vol. 2, p. 70, pl. 20, figs. 3, a, b.
Probably part *smithi* and part *curta* Dall, Trans. Wag., III, p. 1358 and 1381.

For Conrad's description of *pomilia*, see reference above cited.

*Meyer's original description of smithi.*—Solid; irregularly elliptical; subequilateral; with cardinal and lateral teeth; a small but deep lunule inside of a large indistinct one; surface with irregular lines of growth, becoming more regular at the extremities; they are crossed by very indistinct radiating lines, margin crenulate.

*Locality.*—Claiborne, Ala.

Amongst our various collections from Claiborne we fail to find any specimens with quite the comparative breadth or decidedly elliptical form shown by Meyer's figure (herewith copied). But at Woods Bluff such is the prevailing type in the *pomilia*-like specimens. The concentric marking is there however more regular than Meyer's description would imply. We have fully illustrated the Woods Bluff form on pl. 38. Note the general *smithi* shape, with strong concentric raised lines tending to bunch up in great folds, but in no such marked degree as shown in *pomilia* and *alveata* from the Claiborne sand. The depth of the valves, the somewhat twisted appearance of the umbones and the regular liration tend to give the Sabine forms of this species a *Corbis*-like aspect. From the St. Maurice beds of Virginia, at Newcastle we find a form of this variety as shown in pl. 38, fig. 5. And from about the same horizon 3 miles W. N. W. of Orangeburg, S. C. the rather small specimens show comparatively stronger lirations, with beaks located even more posteriorly than in any specimens herewith figured.

**Lucina pomilia** Conrad, Pl. 38. Figs. 6-11.

For description and synonymy, see references given above.

*Pomilia* Con. (or *impressa* Lea), is the name applied to the Claiborne form of this stock, occupying a median ground between the rather smooth, dorsally characteristic *carinifera* and the high, billowy *alveata*. It is certainly represented by figs. 6-10 and it may include fig. 11, according to some authors. As already stated, we have never collected specimens so angularly developed dorsally as represented by Conrad's drawing of *carin-*

*ifera* or Lea's of *cornuta*. Our specimens of this general type are represented by figs. 27-29 (pl. 37). Specimens of the high, *alveata* Con. or *lunata* Lea type (figs. 12-16) are exceedingly abundant in the Claiborne sand at Claiborne. Hence there is no trouble in finding an abundance of "connecting links" between this and the average *pomilia*.

*Types.*—The 4 specimens labelled *pomilia* in the Conradian Collection at the Phila. Academy are doubtless the type specimens. The type of *alveata* is doubtless the rather high and narrow form labelled *alveata*, showing 7 primary concentric undulations.

*Horizon.*—Claiborne Eocene.

*Locality.*—Practically all of our identifiable material coming under *pomilia* and close related forms is from the Claiborne sand at Claiborne. Hence the specimens figured are all from that locality.

**Lucina papyracea** Lea, Pl. 38. Figs. 17-21.

*L. papyracea* Lea, Cont. to Geol., 1833, p. 58, pl. 1, fig. 31.
? *L. modesta* Con. Amer. Jour. Sci., vol. 1, 1846, p. 403, pl. 4, fig. 13.

*Lea's original description.*—Shell orbicular, lenticular, somewhat inflated, concentrically and finely striated, slightly folded behind and subemarginate; substance of the shell thin; lunule cordate; beaks rather pointed; lateral teeth scarcely perceptible; anterior cicatrix short; lines of growth indistinctly marked; cavity of the shell rather shallow; margin crenulate.

Diam. 3-20ths, Length 7-20ths, Breadth 7-20ths of an inch.

*Observations.*—This species has a general resemblance to the *impressa*, but differs in being rather less inflated and in being without the deep impression before the beaks. The posterior fold of *impressa* is greater, and the lateral teeth are much larger. In the present species the striæ decrease in number on the posterior part and there become squamose.

Conrad's original description of *modesta* runs thus:

Orbicular, ventricose, thin, with minute, approximate concentric lines; posterior side with an impressed submarginal fold; posterior margin truncated, direct; ligament margin straight and oblique; beaks prominent, medial.

Dall and Cossmann seem inclined to refer *modesta* to what we term the *pomilia* stock, whereas it seems to us that from Conrad's description it belongs under *papyracea*. There is but one word in Conrad's description out of harmony with this interpretation, —the word ventricose. Otherwise Conrad's description fits *papyracea* very much better than any form of the *pomilia* group. The young of the latter are possessed of strong, not "minute" concentric lines; the ligamental margin is arched, not "straight and oblique" &c., &c.

Lea's expression, "lunule cordate" is very happily modified in his Observations when he says that the species is "without the deep depression before the beaks".

The extended lunular area, the somewhat shallow character of the valves, their thinness, with fine exterior sculpturing not decidedly inclined to billowy concentration serve to make this a fairly distinct and well-defined species. It is doubtless of the *uhleri**-*ulrichi* stock.

*Type.*—There are no specimens in the Lea Collection at the Phila. Academy corresponding exactly to Lea's figures. Perhaps No. 5164 may be the specimen he figured for the left valve though it is but 6-7ths the size of his figure.

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.; Claiborne, Ala.

**Lucina bisculpta** Meyer, Pl. 38. Figs. 22, 23.

*L. bisculpta* Mr., Bull. 1, Ala. Geol. Surv., No. 2, 1886, p. 81, pl. 1, figs. 30, 30, a.

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*In our Bulletin dealing with the Bivalves of the Sabine Stage (vol. II, p. 263, pl. 20, figs. 6, 5, a, 6) we hesitatingly referred the Woods Bluff form to Clark's *uhleri* (by a slip spelling the name *ulrichi*). Since that date Clark has given much more satisfactory figures of his *uhleri* and we have obtained specimens for direct comparison and now find the Alabama and Virginia forms close, yet differing by the generally greater size of *ulrichi*, its longer, more elliptical form, less elevated beaks and lack of a most pronounced, long, oblique truncation posteriorly. Since *ulrichi* has gotten into the literature we will retain it for the present for the Alabama Sabine form of this stock.

*Meyer's original description.*—Thin; convex; oval; anterior margin truncated; beak turned anteriorly; lunule rather small; impressed; cordate; hinge of the right valve with one cardinal and two obsolete distant lateral teeth; inner surface with radiating impressed lines, which crenulate the margin; outer surface with concentric elevated distinct lines; except on the umbo they are separated by rather large and regular distances. *Locality.*—Claiborne, Ala.

The radiating lines of the inside correspond, at some places near the margin, with indistinct rib-like elevations of the surface. By a mistake, the figure of this species, on plate 1, shows two teeth below the beak instead of one.

We have copied Meyer's figures, but have found nothing in our collections closely corresponding. Dall refers this to the *pomilia* stock; Cossmann questions whether or not it is a *Lucina* at all. We would refer it to some variety of *papyracea*.

**Lucina ozarkana** Harris, Pl. 38. Figs. 24-26.

? *L. dartoni* Clark, Bull. 141, U. S. Geol. Surv., p. 79, pl. 20, figs. 2, a-c.
*L. ozarkana* Har. These Bulletins, vol. 2, p. 204, pl. 20, figs. 7, a-b.
*L. convexa* Dall, *partim*, Trans. Wag., III, 1903, p. 1352.

For original description, see Bulletin referred to above.

In this species as found in the Sabine Eocene of Woods Bluff and Ozark, there is little to indicate its possibilities in the St. Maurice stage. In form of outline in interior characteristic and often in size it resembles *ulrichi* very closely. But its dentition is slightly weaker, it is more inflated, has more regular and evenly spaced large, raised concentric lines, and above all shows very striking radiate sculpturing between these lines, spreading out laterally in almost *Camptonectes* fashion. In the St. Maurice beds it perhaps is best displayed at the base of the bluff at Claiborne. It here often shows a variation in diameter from 15 to 50 mm., a considerable variation as to gibbosity, with concentric striation regularly and strongly defined.

It is possible that *dartoni* of the Virginia basin may be a small form of this species as Dall maintains, but from the fact that the Virginia specimens are all small, though presumably of

St. Maurice horizon, with very different muscular impressions (if we can trust the figures of Clark) different outline, different or stronger dentition &c, we prefer to retain the Alabama designation for the Alabama specimens.

*Types.*—Paleont. Mus. Cornell Univ. From the Sabine Eocene beds at Ozark, Ala.

*Horizon.*—Sabine and St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Localities.*—Base of Bluff, Claiborne; Lisbon and Ozark, in the St. Maurice Eocene. Woods Bluff and Ozark, in the Sabine Eocene. Marble Quarry, Winn Parish, La.; Vance's Ferry, S. C.; 2 miles S. of Meridian, Miss. (U. S. N. M.)

**Loripes subvexa** Conrad, Pl. 39. Figs. 1, (2, 3, 4.)?

*L. subvexa* Con., Foss. Shells Tert. Form., 1832, p. 40.
*L. subvexa* Con., Am. Jr. Sci., vol. 1, 1846, p. 403, pl. 4, fig. 14.
*Cyclas subvexa* Con., Amer. Jr. Conch., vol. 1, 1865, p. 8.
*Lucina* (*Loripes*) *subvexa* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 207, pl. 29, fig. 14.
*Lucina subvexa* Dall, *partim*, Trans. Wag., III, 1903, p. 1352.

*Conrad's original description.*—Shell suborbicular; ventricose; with fine concentric and minute obscure radiating lines, posterior side with an obscure fold, anterior side elevated and subangulated above, hinge edentulous; anterior muscular impression not profoundly elongated; cavity very capacious; surface punctate.

In 1846 Conrad adds in the description given in the American Journal of Science: A rare species. I have but one valve, which is thin about the basal margin, thicker above, with a rough unequal radio-punctate interior; the lunule small and impressed, and the hinge plate narrow and without teeth.

There is a fragment of a specimen we would generally refer to "*Loripes*" still in the Conradian Collection at the Phila. Academy, about 25 mm. in diameter, that is probably Conrad's type. It shows well the long anterior muscular scar, the punctate or pitted character and the diagonal long interior impression common to specimens of this genus.

So far as we are aware no one has found this shell in the

Claiborne sand since the day of Conrad, but its occurrence in varietal forms are well-known in the St. Maurice beds below. Even the Sabine has representatives.

It is more globular in form than *ozarkana* and attains a greater size, even 80 mm., or more in diameter. In certain "Buhrstone" layers in southern Alabama this is the most abundant and conspicuous fossil observed. However, on account of its occurrence nearly always in the form of casts it has not been collected and brought into museums as frequently as its importance demands.

Starting with a small, bullet-like variety (*sylværupis*, n. var.) at Woods Bluff as seen considerably enlarged on pl. 39, figs. 3 and 5, the dentition like *ozarkana* seems here still further weakened, yet there is a fairly sharp, compressed tooth in the valve, under the beak ; in the right there is a remnant also of an anterior lateral socket. The hinge line becomes very delicate, the exterior marking is less regular and sharply defined than in *ozarkana* but of the same general type. As the shell increases in size in the St. Maurice beds it has the appearance shown by figs. 2 and 4 of pl. 39, loses all traces of dentition, shows but rarely the fine *Camptonectes* sculpture, but sometimes larger radii as indicated in fig. 4, shows quite generally an anterior angulation, as also indicated in fig. 4, becomes very large and conspicuous, yet the shell substance is perhaps never much over .5 mm. in thickness. The shell when preserved seems to be of a dull, porcellaneous composition, lustreless as the ordinary *Loripes* of today.

It seems strange why this light, very abundant, prolific species was not represented west of the Mississippi.

It is impossible to state at present whether the form here placed under this species, from pre-Claibornian horizons, was really the ancestor of Conrad's *subvexa* of the Claiborne ; or whether the Conradian species was derived from the *ozarkana* strain. The nomenclature of these forms is not definitely settled. Dall regards *ozarkana* as simply the young of *subvexa*, but admits there is another larger species occurring in the St. Maurice stage.

*Type.*—Of the sp., Phila. Acad. Of var. Mus. C. U.

*Horizon.*—Sabine-Claiborne inclusive.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Localities.*—Sabine, Woods Bluff, Ala. St. Maurice, Hamilton Bluff, Ozark, Lisbon, Ala.; Ft. Gaines, Ga.; Eutaw Springs?, S. C.

**Lucina pandata** ~~Dall~~, Conrad Pl. 39. Figs. 6, 7

*L. pandata* Con., Amer. Jr. Sci., vol. 23, 1833, p. 343.
*L. compressa* Lea, Cont. to Geol., 1833, p. 55, pl. 1, fig. 27.
*L. compressa* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 206, pl. 29, fig. 5.
*Phacoides* (*Miltha*) *pandatus* Dall, Trans. Wag., III, 1903, p. 1374.

*Conrad's original description.*—Shell oval, compressed, obscurely cancellated; anterior side somewhat currugated; beaks nearly central; teeth three in one valve; anterior muscular impression profoundly elongated; lunule excavated, minute. Length one inch and one fourth.

*Locality.*—Claiborne, Alab., *London clay.* This shell is allied to *Lucina mutabilis* Lam.

This is the most abundant large *Lucina* of the Claiborne Eocene. At Claiborne it is often thickened within, showing muscular scars and pitting, deeply depressed. This thickening is perhaps not so common in the St. Maurice beds. We have found no specimens of this species west of the Mississippi but it occurs fairly abundantly in form of casts on the Neuse River, N. C.

*Types.*—The specimens in the Conradian Collection, Phila. Acad.

*Horizon.*—St. Maurice and Claiborne Eocene.

*Specimens figured.*—Claiborne specimens in the Paleont. Mus. Cornell Univ.

*Localities.*—Claiborne, Lisbon, Ala. Rock Landing, Neuse River, N. C.

**Lucina claibornensis** Conrad, Pl. 39, Figs. 8, 9.

*Cyclas claibornensis* Con. Amer. Jour. Conch., vol. 1, 1865, p. 146.

*Phacoides* (*Miltha*) *claibornensis* Dall, Trans. Wag. III, 1903, p. 1374, pl. 50, fig. 18.

*Conrad's original description.*—Suborbicular compressed, inequilateral; beaks small and acute; disk with concentric, prominent, numerous lamelliform striæ; ligament margin straight, oblique; posterior end truncated, or slightly emarginate; ventral margin profoundly rounded.

Height 1½ inch. Length 1½ inch.

*Locality.*—Claiborne, Alabama.

This shell occurs in the group at the base of Claiborne Bluff, belonging to an older division of the Eocene than the Claiborne group above. The cardinal teeth are prominent, and the pits profound.

Dall is mistaken in his explanation of pl. 50, fig. 18, where he refers this species to the "Claiborne Sands". It is strictly a St. Maurice form. The specimens herewith figured, from Lisbon, have less widely separated raised concentric ridges and the cardinal margin is more curved than the specimens from the type locality at the base of Claiborne Bluff. Conrad's type as well as our specimens from that locality show clearly these differences.

*Type.*—Phila. Acad. Nat. Sci.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Paleont. Coll. Cornell Univ.

*Localities.*—Base of Claiborne Bluff, Ozark, Lisbon and Hamilton Bluff, Ala.; Ft. Gaines, Ga.; just below City Point, James River, Va.

**Lucina rotunda** Lea, Pl. 40. Figs. 1, 2.

*L. symmetrica* Con., Foss. Sh. Tert. Form., 1833, p. 40.

*Cyclas symmetrica* Con., Amer. Jour. Conch., vol. 1, 1865, p. 9.

*L. rotunda* Lea, Cont. to Geol., 1833, p. 56, pl. 1, fig. 28.

*L. rotunda* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 205, pl. 29, fig. 6-8.

*L. symmetrica ?* Harris. These Bulletins, vol. 2, p. 263, pl. 14, fig. 4.

*Lea's original description.*—Shell orbicular, compressed, equilateral concentrically and finely striate, flattish over the umbones, folded before; substance of the shell thick, lunule small, lanceolate; beaks very small, pointed, recurved; cardinal teeth indistinct; cicatrices impressed, the anterior one rather long; lines of growth numerous near the margin; cavity of the shell very shallow, having rather a large furrow across its centre; margin entire.

Diam. .6, Length 1.1, Breadth 1.1 of an inch.

*Observations.* Single valves of two individuals only have come into my possession. Its orbicular form and beautiful concentric striæ distinguish this species. In these two specimens there are no marks of growth except near to the margin, where, on one specimen there are four, on the other seven. These cause a thickening of the margin.

We quite agree with de Gregorio and Dall that Conrad's description is too imperfect to be used in identifying this form. Had he even mentioned the size of the shell it would have helped wonderfully in its identification.

*Types.*—No. 5152 is the type of the left valve figured by Lea. The right valve used in figuring is missing.

*Horizon.*—Uppermost Sabine-Claiborne Eocene.

*Specimens figured.*—Paleont. Museum Cornell Univ. from Claiborne.

*Localities.*—Hatchetigbee Bluff, Claiborne, Ala.

**Corbis claibornensis** Dall, Pl. 40. Figs. 3, 4.

*C. lamellosa* Con., non. Lam. Foss. Sh. Tert. Form, 1833, p. 41, Harris' Reprint, pl. 19, fig. 5.
*C. lamellosa* Con., Amer. Jour. Sci., vol. 1, 1846, p. 401, pl. 4. fig. 16.
*Gafrarium liratum* Con., Amer. Jr. Conch., vol. 1, 1865, p. 9.
*C. claibornensis* Dall, Trans. Wag., III, 1903, p. 1393.

Conrad, though referring this form to *lamellosa* Lam. in 1833, gave a short description which runs as follows :

> Elliptical, cancellate, with elevated, concentric, remote laminæ ; interstices with crowded, regular, transverse striæ ; inner margin crenulated.

In 1846 he still referred it to the Paris Basin species, remarking :

> The extreme scarcity of this shell at Claiborne is remarkable, as it is very abundant in the Paris Eocene. It varies little from the Paris specimens, the principal difference being in the thicker and more approximate ribs towards the base.

Conrad evidently concluded some time before 1865 that the American and European forms were specifically distinct, for in that year he denominates his species *G. liratum*. This as Dall points out was practically preoccupied by d'Archiac's *Lucina* (*Corbis*) *lyrata*, hence the name introduced by Dall.

*Type*.—The single specimen in the Conradian Coll. Acad. Nat. Sci., Phila., may be taken for the type.

*Horizon*.—Claiborne Eocene.

*Specimen figured*.—Paleont. Mus. Cornell Univ.

*Locality*.—Claiborne, Ala.

**Corbis undata** Conrad, Pl. 40. Fig. 5.

*C. undata* Con., Foss. Sh. Tert. Form., 1833, p. 41 ; pl. fig. 6, of Harris' Reprint.
*C. distans* Con., *Ibid.*, p. 41.
*Gafrarium distans* Con., Amer. Jr. Conch., vol. 1, 1865, p. 8.
*Corbis undata* Dall, Trans. Wag., III, 1903, p. 1392.

*Conrad's original description*.—Suboval, convex, with radiating striæ, and elevated concentric undulations on the umbo, and impressed lines on the inferior portion of the valve, where the radiating lines are obsolete ; umbo rather ventricose ; beaks central, inner margin crenate.

Dall remarks, *op cit.* : Conrad described the adult (*undata*) and young (*distans*) shells as separate species in 1833 ; he united them under the name *undata* in 1846 ; in 1865 having apparently forgotten his consolidation, he united them a second time under *distans*. The first rectification of course, must take precedence.

Perhaps Conrad's second rectification was due to the fact that the name *distans* preceded *undata* on p. 41 where they were both used. De Gregorio adopts *distans* as the correct name.

*Types*.—Specimens in the Conradian Coll., Phila. Acad.

*Horizon*.—Claiborne Eocene.

*Specimens figured*.—Paleont. Mus. Cornell Univ. from Claiborne.

*Locality*.—Claiborne, Ala.

**Sphærella anteproducaa** Harris, Pl. 40. Figs. 6-8.

*Sphærella ? anteproducta* Har., Proc. Phila. Acad. Nat. Sci., 1895, p. 50, pl. 2, Fig. 4.
*Dipl. turgida* Dall, *partim*, (not Conrad), Trans. Wag., III, 1900, p. 1181.

*Harris' original description.*—Size and general form as indicated by the figure; anterior somewhat produced, laterally compressed; posterior dorsal margin likewise somewhat compressed; ventricose.

This species is much more ventricose than *inflata* Lea, from the Claiborne, and scarcely as much so as *turgida* Con. from the Vicksburg beds. The umbones are intermediate in size between *inflata* and *turgida*, the size greater than either.

Dall combines *turgida* of the Vicksburg Oligocene beds with *bulla* from the Jackson and *anteproducta* from the St. Maurice beds. Leaving aside the relationship of *turgida* and *bulla* for future consideration, it may now be stated that the present writer, with the U. S. Museum material as used by Dall, plus large collections from Texas and the Philadelphia Academy material under examination, saw a somewhat marked dissimilarity between the Jackson *bulla* (fig. 9) and the St. Maurice *anteproducta* (figs. 6, 7, 8). The illustrations herewith given will assist in showing such differences. Others might be given showing a much wider range of variation. Our MS notes made at the Academy (1892) with the Texas *anteproducta* and the Jackson *bulla* in hand for comparison read: *Sphærella bulla* Con., from "Enterprise, Miss." [i. e. Jacksonian] consists of two very imperfect fragments. The anterior part is evidently less pointed than in the Texas *Sphærella*.

It has frequently seemed strange that these inflated Sphærellas should be filled and sealed up so that the internal characteristics are very difficult to determine. The interior is quite frequently a clay iron-stone. Perhaps the mystery is solved to some extent by the study of the dentition of a specimen found in loose marl at St. Maurice. The dentition (see pl. 40, figs. 8 a, b) consists—in the right valve—of an anterior cardinal, long, sickle-shaped, curving well up into the beak of the opposite valve; a posterior compound cardinal with one prong extending backwards at an angle of perhaps 45 degrees with the hinge margin and with a second prong extensively developed backwards into an almost paddle-shaped extremity connected however below, marginally by an extension, to the umbonal region of the shell. This paddle-like portion of the tooth is twisted so that in viewing the hinge from above, or laterally, it is seen at an angle of perhaps 45 degrees. In the left valve the representative of the usually narrow little bifid tooth is two almost separate plates leaning together above and passing well into the right valve. The posterior tooth so over-locks the paddle-shaped process that it is quite impossible to open the shell but slightly without fracturing the teeth.

So far as we are aware this is the most vigorously developed hinge dentition yet described under the genus *Sphærella*. Conrad founded the genus on *subvexa*, a Miocene fossil from the James River, Va., having only the left valve before him (Medial Tert., 1838, p. 18, pl. X, fig. 2). In 1871 his knowledge of the genus had so increased that he described the dental conditions in the right valve (Amer. Jour. Conch., vol. 6, p. 200, pl. 11, fig. 9). Summing up the general characteristics he says :

> Hinge of right valve with three cardinal teeth, the two anterior teeth small, entire ; posterior tooth rather elongated, parallel with the hinge margin and slightly grooved.
>
> The above diagnosis shows a wide difference in this genus to *Diplodonta* or *Felania*. The muscular impressions are larger than those of the allied genera and the posterior cicatrix is much nearer the ventral margin. The posterior tooth described above may be said to coalesce with the adjacent tooth at the base. The left valve has one small direct cardinal tooth under the apex and an elongated, compressed, very oblique tooth, with a pit between them. All the species are subsphæroidal, and constitute a group of rounded bivalves with a profounder cavity than exists in any other genus.
>
> There is one species in the Miocene of Virginia, one in the Oligocene at Vicksburg, and the recent *Lucina orbella*, Gould, is a species of *Sphærella*, in which the muscular impressions are very large and unlike those in *Diplodonta*.

Conrad doubtless knew in '71 that he had been mistaken in 1865 (Amer. Jr. Conch., vol. 1, p. 9) in referring *inflata* and *levis* to this genus ; but why he should have omitted to mention his *bulla*, p. 138, *ibidem*, no one now can tell.

Dall could not possibly have had in hand specimens from which he could determine the hinge in the present species or he never would have lumped it in with the *Diplodontæ*. (Trans. Wag., III, p. 1179-82).

Specimens showing interior characteristics are very rare, and we have found none showing in a satisfactory manner the characteristics of the muscular scars. The more robust development of the teeth in this species, as compared with the specimens Conrad studied suggest the modifying of his generic description so as to include the strong, sickle-shaped anterior in the right valve and the decidedly bifid or twinned anterior cardinal in the left valve. The long, posterior cardinals are remarkable in their greatly developed, practically free, posterior extension and interlocking character. Conrad's Miocene "type" form unfortunately represents a decadent and senile strain of this virile genus. This fact has doubtless led to such statements as: "It is evident, therefore, that *Sphærella* can be regarded at most as a section of *Diplodonta*, closely allied to the typical form of that genus." Again, regarding the species in question: "This remarkable globular species is not a *Sphærella*, but simply a turgid *Diplodonta*." (Trans. Wag., III, p. 1182).

This species is well distributed in Texas, but perhaps no other locality can well compare for abundance and size and variety of specimens with St. Maurice, La.

*Type.*—Singley's Collection, Tex.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Deposited in Paleont. Coll. Cornell Univ., from St. Maurice, La.

*Localities.*—Texas: Cedar Creek, Wheelock League, Robertson Co., cutting on Tyler and S. E. R. R., 400 yds. S. of mile post No. 23, Cherokee Co.; Dr. Collard's farm, Sparks Headright, Brazos Co.; Elm Creek, Lee Co.; Smithville. La.: St. Maurice, Natchitoches, Vivian, Marble Q'y, ? Cedar Bluff, Sabine R. Miss.: McLeod's Mill, Suwanlovey Cr., Clark Co.

**Diplodonta ungulina,** Pl. 40. Figs. 10-14.

*Astarte unglina* Con., Am. Jr. Sci., vol. 23, 1833, p. 342.
*Egeria rotunda* Lea, Cont. to Geol., 1833, p. 50, pl. 1, fig. 17.
*Diplodonta astartiformis* Con., Jr. Phila. Ac. Nat. Sci., 1860, vol. 4, 296.
*Diplodonta deltoidea* Con. Jr. Phila &c., vol. 4, p. 296.

*Mysia astartiformis* Con., Amer. Jour. Conch., vol. 1, 1865, p. 147, pl. 11, fig. 15.
*Mysia deltoidea* Con., Amer. Jr. Conch., vol. 1, 1865, p. 147, pl. 11, fig. 10.
*Diplodonta ungulina* Dall, Trans. Wag., III, 1900, p. 1181.

*Conrad's original description.*—Shell slightly elevated, or obovate, a little convex, with fine concentric sulci, becoming obsolete with age; beaks inclining a little forward and the apex acute; inner margin entire: lunule none. · Length half an inch. (Claiborne, Ala.)

*Diplodonta marlboroensis* Clark and Martin, Geol. Surv. Md., 1901, Eocene, p. 173, pl. 36, fig. 4, may be a variery of this species.

This is one of the most abundant fossils at Claiborne. It varies considerably in thickness of the shell, outline and size. Occasionally an almost discoid form is seen; occasional specimens twice the usual size are apt to be discoidal and rather thin.

*Type.*— ?

*Horizon.*—Claiborne and St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Localities.*—Claiborne and Lisbon, Ala.

**Diplodonta nana** Lea, Pl. 40. Figs. 15, 16.

*Egeria nana* Lea, Cont. to Geol., 1833, p. 55, pl. 1, fig. 26.
*E. ? nana* Con., Amer. Jr. Conch., vol. 1, p. 5, 1865.
*Diplodonta ungulina* de Greg., *partim.*, Mon. Faun. Eoc. Ala., 1890, p. 208.
*Felaniella nana* Dall, Trans. Wag., III, 1900, p. 1181.

*Lea's original description.*—Shell rotundo-oblique, compressed, angular above, subequilateral, concentrically striate; substance of the shell rather thin; beaks pointed, cicatrices imperceptible; cavity of the shell shallow—of the beak angular; margin entire.

Diam. .1, Length 5-20, Breadth 5-20ths, of an inch.

*Observations.*—Closely resembles the *rotunda.* It has, however, somewhat larger concentric striæ—is a much smaller shell and is more oblique.

Dall refers this species to *Felaniella*, a subdivision of *Diplodonta.* The same he describes as follows: Shell like *Diplodonta*, but heavy, compressed, externally smooth, with a conspicuous, usually dark epidermis, and less equilateral valves.

We herewith figure some small specimens that would be referred by most authorities to *nana*. But the concentric striation is not coarser than in *ungulina*, the shell substance is rather thick and the muscular scars are well-defined. These latter features differing from Lea's description show he must have had samples of young *ungulina* in hand while describing this species. In a few specimens, like those figured there is a certain obliquity of the shell not generally shown in young *ungulina*; also the strong, apparently adult bifid character of the posterior cardinal in the right valve contrasts rather strongly with the narrow, often simple representative in *ungulina*. There is almost a scaly, knife-edge sharpness about the periphery of the shell suggesting perhaps an epidermis as referred to by Dall under *Felaniella*. We have no specimens at all comparable with Lea's in size, ¼ inch in diameter!

*Type.*—Probably No. 5142, Lea Coll., Phila. Acad., but there is considerable doubt in the matter as shown by Lea's description.

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Locality.*—Claiborne, Ala.

**Diplodonta inflata** Lea, Pl. 40. Figs. 17-19.

*Egeria inflata* Lea, Cont. to Geol., 1833, p. 50, pl. 1, fig. 18.
*Lucina* (*Sphærella*) *lævis* var. *paruminflata* de Greg., Mon Faun. Eoc. Ala., 1890, p. 207, pl. 29, figs. 16-17.
*Diplodonta sp.* Harris. These Bulletins, vol. 2, p. 257, pl. 19, fig. 7.
*D. inflata* Dall, Trans. Wag., III, 1900, 1182.

*Lea's original description.*—Shell subrotund, rather transverse, inflated, subequilateral, very finely and concentrically striate, substance of the shell very thin; beaks rather elevated; posterior slope furnished with an indistinct fold. Cicatrices scarcely perceptible; cavity of the shell much excavated, of the beaks deep and rounded, margin entire.

Diam. .2, Length 7-20, Breadth 7-20ths of an inch.

As Dall remarks this shell is never really much "inflated". Hence Gregorio's variety.

This species has a more squarish form, is thinner and is far more rare in the Claiborne sand than *ungulina*.

*Type.*—No. 5088, Lea Coll., Phil. Acad.

*Horizon.*—Sabine-Claiborne inclusive.

*Specimens figured.*—Paleont. Mus. Cornell Univ.; Claiborne, Ala.

*Localities.*—Sabine: Woods Bluff.
St. Maurice: Winnfield Marble Quarry, La.
Claiborne: Claiborne, Ala.

**Diplodonta corbiscula**, n. sp., Pl. 40. Figs. 20, 21, a

*Specific characterization.*—Form and size as indicated by the figure and explanation; anterior nearly 50 per cent longer than posterior; cardinal margin strongly developed with a very strong bifid anterior cardinal tooth and a small posterior one; ligamental channel short, curving from beak to inner margin of shell not far behind the small posterior cardinal; muscular impressions rather large and ill-defined; interior rudely radiately striate; exterior smooth, save very fine concentric lining; lunule wanting.

The cutting away of the shell margin just anterior to the heavy bifid tooth in the left valve (the only one known) would seem to indicate that there was a very strong anterior cardinal in the right valve; doubtless the bifid posterior was strongly developed as the pit is wide and deep in the left valve. Though the shell is thick about the cardinal margin it is thin basally.

The margin of the valve tends to make lateral teeth. First, as seen just before the bifid cardinal, a narrow fold on the margin winds out from under the beak and as it passes up over the middle of the edge of the shell it is rather prominent and lateral-tooth-like. Second, the margin of the shell just posterior to the basal end of the ligament channel is somewhat tooth-like.

*Type, etc.*—Paleont. Mus. Cornell Univ., from Claiborne Eocene, Claiborne, Ala.

**Chama monroensis**, Pl. 41. Figs. 1, ? 2-4.

*C. monroensis* Ald., The Nautilus, vol. 26, Jan. 1903, p. 100, pl. 4, fig. 15.

*Aldrich's original description.*—Shell of medium size, strongly rugosely plicated, lamellar. Upper valve with 6-8 leaves turned up to nearly a vertical at their ventral edges, each leaf covered with radial raised lines running in couples. Upper valve slightly convex, lower valve convex and inequilateral.

Resembles somewhat *C. corticosa* Con., but is smaller and more profusely ornamented. One lower valve has twelve leaves or corrugations.

*Locality.*—The *Ostrea sellæformis* bed, at White's Marl bed, Monroe Co., Alabama.

In our collection from Wautubbee, Hickory, and 8 miles W. of Enterprise, Miss., and Orangeburg, S. C., made in 1898 there are several valves of a *Chama* belonging presumably to Aldrich's species though what he calls the upper valve seems to us to be the attached valve. He does not figure the "lower valve". We simply know that it is convex and one valve "has 12 leaves or corrugations". In ours the upper valve is intensely foliate as shown in the figure (fig. 3).

A specimen of a lesser valve of a species with beaks gyrating in the opposite direction from the above is shown as fig. 4, from between Orrell's Crossing and Evergreen Crossing of Elm Creek, Lee Co., Tex.

**Cardium harrisi** Vaughan, Pl. 41. Figs. 5-7.

*C. harrisi* Vaughan, Bull. U. S. G. S., 142, 1896, p. 37, pl. 4, figs. 1, 2.
*C.* (*Tropidocardium*) *harrisi* Dall, Trans. Wag., III, 1900, p. 1092.

*Vaughan's original description.*—Shell large, ventricose umbones very prominent, incurved, situated about half-way between the anterior and posterior terminations of the shell. Anterior portion somewhat rostrate; anterior margin gradually rounded. Base gently curved. The posterior almost straight, rounding to meet the basal margin. Nineteen broad ribs anterior to the umbonal slope.* Posterior to the umbonal slope the ribs do not show on the cast. Length 74 mm.; height (from basal margin to the highest point of umbonal prominence), 70 mm., diameter, 56 mm.

The figure and description are made from an excellent internal cast.

Specimens from Winn Parish show clearly that some of the ribs on the post-umbonal slope are provided with huge saw-tooth-like flat spines. Excellent material from the base of Claiborne bluff

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*The large variety of this species which may be called *gainesense* has 33-36 ribs "anterior to the umbonal slope."

shows that the interspaces usually have a medially depressed radiating line, while the ribs show a slight tendency medially to show projections. On the rib marking off the umbonal slope the projections are huge saw teeth.

This shell seems to be the direct descendant of Aldrich's *hatchetigbeense* of the upper Sabine of Ala.

*Type.*—(Figs. 5, 6) Nat. Mus. Coll., Wash., D. C.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Paleont. Museum Cornell Univ. from Lisbon, Ala.

*Localities.*—Mt. Lebanon; near Homer; L. P. Saunders' place, S. 18, 22 N., 12 W.; near Redland, S. 19, 23 N., 12 W.; Winn Parish (S. of Marble Q'y), La.

Walnut Bluff, Ouachita River, Ark.

Lisbon and base of Bluff, Claiborne.

Ft. Gaines, Ga.

**Cardium (Trachycardium) claibornense** Ald., Pl. 41. Figs. 8, a, 9.

*C.* (*Trachy.*) *claibornense* Ald. These Bulletins, vol. 5, p. 3, pl. 1, fig. 4, 1911.

*For Aldrich's description*, see page and vol. cited.

*Type.*—Aldrich Coll., Johns Hopkins Univ.

*Horizon.*—Claiborne Eocene.

*Type figure* herewith copied.

*Localities.*—De Sota, Miss.; Claiborne, Ala.

Figure 9 is from a specimen in the Texas Survey material at Austin from Collier's Ferry, Burleson Co., Tex. It has very much the general appearance of *claibornense*.

**Cardium ouachitense**, n. sp., Pl. 42. Fig. 1

*Specific characterization.*—Left valve—the only one known—very large (100 x 80 x 40 mm.), rather long, with high, prosogyrate beak; rotund throughout, not flattened medially as in *harrisi*; ribs strong, rather distant, seemingly rather acute and narrower than interspaces.

One instinctively thinks of *C. magnum* while looking upon this specimen, but *magnum* has many more ribs, is more oblique and has less extended, less prosogyrate beaks.

*Type.*—Deposited in Paleont. Lab., C. U.

*Horizon.*—St. Maurice Eocene.

*Locality.*—Vicinity of Long Point, ½ mile below Alabama Landing, west side of the Ouachita River, La.

**Protocardia gambrina** Gabb, Pl. 42. Figs. 2, 3.

"*? P. diversa*" Gabb, Proc. Acad. Nat. Sci., Phila., 1861, p. 370.
*P. gambrina* Gabb, *idem*, p. 371.
*P. harrisi* Dall, *at least in part*, Trans. Wag., III, 1900, p. 1113.

Regarding this species Gabb remarks : "*P. diversa Con. sp.* —A small specimen from Houston Co., Texas, from an Eocene deposit presenting most of the characters of this species, but differs in some few points. It has the form of the typical specimens of *P. diversa* except that the buccal extremity is more regular, the basal margin is entire, and not sinuous as in adult specimens of that species ; this may be however merely the effect of the difference in age. The anterior portion is marked by obsolete cancellations, and the posterior radiations are somewhat different. The ribs are broad and rounded, with small bars placed at short intervals connecting them, while in the young state of *P. diversa* the ribs are linear with wide spaces and without connecting bars. In that species, also, the radiating portion of the surface blends into the adjoining surface by the ribs becoming obsolete, while in this specimen the same portion ends abruptly, the ribs all being of the same size. It will be necessary to examine more specimens to decide whether this is the young of the above species or distinct. Should it prove so, I suggest the name *P. gambrina*."

Dall remarks regarding this form : "*P. gambrina* Gabb, from the Oligocene of Texas, is the young of *P. diversa*, as Gabb suspected." (Trans. Wag. , III, p. 1114.)

Dall seems to have overlooked the fact that this is an Eocene fossil; this confusion doubtless was brought about by Gabb's comparing it with a Vicksburg form.

The small, and presumably often young, specimens of this genus from the St. Maurice beds of the Gulf States are rather hard to identify; but judging by the form, without umbonal ridge as in *nicolleti* and *diversa*, and the indications of beading along the sides of, rather than on the top of, the posterior ribs as in *nicolleti* it is evident we are dealing here rather with the well-defined form to which Dall has given the name *harrisi* rather than with members of the *nicolleti* stock. But since Gabb's name *gambrina* was given so long before Dall's the laws of nomenclature demand that Gabb's shall be used for this form of *Protocardia*. The name *harrisi* may perhaps be retained to denote the rather small, though adult, specimens found in the upper Sabine beds at Woods Bluff and elsewhere at about the same horizon.

*Type*.—Acad. Nat. Sci. Phila.

*Horizon*.—Sabine-St. Maurice Eocene.

*Specimen figured*.—Alabama Bluff, Trinity River, Houston Co., Tex.

*St. Maurice localities*.—Smithville. Bastrop Co.; Alabama Bluff, Houston Co.; K. Jones' well, Hodge headright, Houston Co., Texas. Hammett's Branch, La. Lisbon, Ala.

**Protocardia salrivalis**, n. sp., Pl. 42. Figs. 7-9.

*Specific characterization*.—General aspect as figured; small (12 x 11 x 8 mm.); surface covered with very fine concentric striæ, and where slightly decorticated, with fine radii which become gradually stronger as the umbonal angle is approached and from there to the posterior margin become prominent.

The length of the shell (from anterior to posterior) is a little greater than one might judge from the illustration, as this dimension is somewhat shortened by the fact that the posterior is turned slightly towards the observer. The posterior radii seem to be imbricated by numerous strong growth lines.

*Type*.—Dep't Pal. Mus. C. U.

*Horizon, specimen figured, locality.*—St. Maurice, La. (At the mouth of Saline Bayou.)

An imprint in ferruginous matter from Bayou Negreet seems to be referable to this species.

**Meiocardia carolinæ** Harris, Pl. 42. Fig. 11.

*M. carolinæ.* These Bulletins, No. 33, Mar., 1919, p. 14, pl. 2, figs. 5, 6.

For original description see the above reference.

*Type.*—Paleont. Mus. Cornell Univ.

*Horizon.*— St. Maurice and Jackson.

*Specimen figured.*—17 miles above Newburn, Neuse River, N. C.

The imprints of the exterior of specimens from this locality show the finer markings and even the posterior radiating ridges better than the Jackson types do.

A large cast is in our collections marked "Kinston, N. C."

### **Meretrix** (*sen. lat.* of Fischer)

### *Perovata stock*

This stock is well differentiated in the upper Sabine at Woods Bluff, Ala., in a form heretofore referred to *perovata* or *subimpressa* (with a query), but which deserves to be given a a designation of specific rank. See *sylværupis* below. The majority of the members of this stock were smooth and polished exteriorly. Where concentric markings occur they are smooth-topped undulations without sharply incised lines. The pallial sinus is well defined, either deep U-shaped or sub-biangular. As a rule the species are flattish, but in the typical *perovata* of the Claiborne sand become greatly developed umbonally.

Passing upward from the Woods Bluff horizon it may be noted that the *subimpressa* of the Virginia Basin is more elliptical, thinner, and with a shallower pallial sinus, while the variety *lisbonensis* at Lisbon, Ala., gradually broadens towards *subvitrea* de Greg. though not equally thick. On the Neuse River, N. C. the large *neusensis* with its incrassated interior, powerful hinge and generally biangulate pallial sinus is extremely abundant in the form of casts. The Claiborne brings forth the typical *perovata* in great abundance. It shows a tendency fore and aft to even, well-defined concentric corrugation and passes into variety *aldrichi*. One off-shoot becomes decidedly corrugate and returns to the primitive flattish state and has received the name *mortoni*. In the Jackson the *subvitrea* form is known as *annexa*; the *aldrichi*, as *pearlensis*.

**Meretrix sylværupis**, n. sp., Pl. 43. Fig. 1.

*C. perovata*? Ald., Bull. 1, Geol. Surv. Ala., 1886, p. 53.
*M. subimpressa* var. Har. These Bulletins, vol. 2, 1897, p, 255, pl. 18, figs. 6, 7.

The general characteristics of this form have already been discussed. With a much greater amount of material containing all stages of growth of *subimpressa* it is evident the two species are quite distinct. Figures of *subimpressa* (figs. 2 and 3), from Pope's Creek, Md., are here introduced for comparison with this Woods Bluff, Sabine, form. It is also clear that this merges, through the St. Maurice var. *lisbonensis* into *perovata* of the Claiborne sands.

*Types.*—(The two specimens figured on pl. 18, vol. 2, of these Bulletins; in C. U. Mus.)

*Horizon.*—Sabine Eocene, upper beds.

*Specimen figured.*—Paleont. Mus. Cornell Univ.

*Locality.*—Woods Bluff, Ala.

**Meretrix neusensis**, n. sp., Pl. 43. Figs. 4-7, 10.

*Specific characterization.*—General appearance as figured; nearly smooth centrally, somewhat undulate peripherally; rather longish, at some localities, with exceedingly thick shell in the umbonal regions but thin basally; interior of the shell not capacious, not extending up into the beaks behind the cardinal plate; hinge heavy, broad.

This shell has the appearance of having been filled up with shell matter from within, leaving the muscular scars and pallial sinus very deeply sunken in the shell mass. In casts of the interior, these features appear very prominent. The greatest depth of the shell is at the anterior curve or angulation of the pallial sinus. The complete filling of the umbonal region with shell matter is somewhat unusual.

Variety *lisbonensis* (described under *perovata*), if larger and thicker would appear exceedingly close to this form. The outline of the shell is often very much like that of *pearlensis*. It is difficult to say whether this species is more closely related to *lisbonensis* or *subimpressa*. Some specimens could very well be referred to mutations of either. The pallial line is somewhat distant from the basal margin of the shell, reminding one of *Crassitellites*; this is especially true in the very much shortened varieties of the species.

Casts of this species are exceedingly abundant in the coarse silicious limestone about Newbern. Occasionally other species are found. At first we are astonished at the great amount of variation this species shows. But, still, *perovata* in the Claiborne shows just as much. Rarely we find pseudomorph which assists greatly in determining the exterior characteristics (fig. 7, a). Though the shell matter is often very thick, the diameter of the valves is never proportionally so great as in typical *perovata*. In fact, this seems to be a less specialized form, an overgrown *lisbonensis*.

*Type.*—Paleont. Mus. C. U.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Cornell Univ.

*Localities.*—In the "Trent formation" about Newbern, N. C., especially at Rocky Landing on the Neuse above Newbern, Har. Coll.; 16-17 above Newbern, Neuse River, Exp'd .'98.

**Meretrix perovata** var. **lisbonensis**, n. var., Pl. 43. Figs. 8-9.

*Varietal characterization.*—General features as figured, appearing in some elongate forms singularly like *sylværupis*, but without the long anterior, and concave lunular margin of that species, therefore approaching in outline *subimpressa* Con., but with deeper valves and passing gradually through shorter forms (fig. 10 and var. *subvitrea* de Greg., fig. 11) into typical *perovata*.

*Types.*—Paleont. Mus. C. U.

*Horizon.*—St. Maurice and Claiborne Eocene.

*Specimens figured.*—Paleont. Mus., Cornell Univ.

*Localities.*—Lisbon, base of Claiborne Bluff, Ala.; 3 and 6 miles W. N. W. of Orangeburg, S. C.

**Meretrix perovata** Con., Pl. 43. Figs. 11, 12 a, 13.

*Cytherea perovata* Con., Foss. Sh. Tert. Form., Aug., 1833, p. 37.
*Cytherea comis* Lea, Cont. to Geol., Dec., 1833, p. 66, pl. 2, fig. 41.
*Dione perovata* Con., Jr. Amer. Conch., vol, 1, 1865, p. 6.
*Cytherea æquorea* vars. *comis* and *cominduta* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 217, pl. 34, fig. 1, 2, 3, 4, 6, 7,

*Conrad's original description.*—Shell cuneiform, ovate, convex, smooth and polished, slightly sulcated on the inferior half of the valves; posterior side slightly compressed and cuneate; umbo tumid, beaks almost anterior; two anterior cardinal teeth in the right valve, approximate and parallel; lunule cordate and defined by a simple impressed line. Length 1½ inches. Breadth 1 inch. *Claiborne.* Cab. Acad., N. S.

That this is an extremely variable species we are ready to admit, ranging from the tumid, typical forms with but the peripheral beginnings of coarse liration, through more extensively marked, somewhat less inflated specimens called var. *aldrichi* (pl. 24, figs. 1, 2) to the large flat *mortoni* with its strong even concentric lirations. In the Jackson the *subvitrea* var. is represented by *annexa* Con. and the *aldrichi* var. by *pearlensis* Har. But, that it is a variety of *æquorea* we seriously question. Gregorio's *cominduta* seems to include both *mortoni* and our variety *aldrichi*.

For a discussion of var. *aldrichi* Har., see these Bulletins, vol. 1. 1895, p. 48, pl. 1, fig. 1.

*Type.*—(Of *perovata*, Phila. Acad., of var. *aldrichi*, Texas

Univ. Mus., Austin).

*Horizon.*—Claiborne and St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Localities.*—Claiborne and Lisbon, Ala. Shell Bluff, Ga. These Georgia imprints and casts seem closely related to *perovata* and *neusensis*.

**Meretrix mortoni** Con., Pl. 43. Figs. 14, 15.

*Cytherea mortoni* Con., Jr. Phila. Ac. Nat. Sci., vol. 7, 1834, p. 150; pl. 20, fig. 1. Harris' Reprint Con. Foss. Sh., &c.

*Dione mortoni* Con., Am. Jr. Conch., vol. 1, 1865, p. 6.

*Cytherea æquorea* var. *cominduta* de Greg., *partim*, Mon. Faun. Eoc. Ala., 1890, p. 217, pl. 34, fig. 5.

*C. æquorea* Cossm., Notes Compl. &c., 1893, p. 10, var. *mortoni*.

*Conrad's original description.*—Shell ovate, convex, with numerous regular impressed lines; lunule cordate, defined by an impressed line. Length two inches, height one and a half inches.

*Locality.*—Claiborne, Ala.

Allied to *C. æquorea*, *nobis*, (*C. hydii* Lea) but is a much larger species, with more regular sulci. It is not uncommon at Claiborne, and I could readily distinguish it from *C. æquorea* in every stage of growth. I give it the name of my friend, Dr. S. G. Morton, through whose kind assistance I was enabled to visit the most remarkable tertiary deposits in the southern states.

There is, to be sure, a somewhat superficial resemblance to be noticed between this form and *æquorea*, but it appears to us that there is no close real relationship between the two; in fact they would seem to belong to two quite distinct stocks of the genus. *Mortoni* is much larger, more elliptical in outline, less cuneiform, thinner, and with a more arching ligamental margin and much more perfect, or even, surface undulations. It is a flattened-out *perovata* with the lines, shown peripherally in that species, drawn over the whole surface.

*Type.*—Phila Acad. (*Mortoni* card contains also *perovata* and *P.* var. *aldrichi.*)

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Locality.*—Claiborne, Ala.

**Meretrix æquorea** Con., Pl. 44. Figs. 3-6.

*Cytherea æquorea* Con., Foss. Shells &c., Aug., 1833, p. 36, (See Harris' Reprint, pl. 20, fig. 5.
*C. hydii* Lea, Cont. to Geol., Dec., 1833, p. 66, pl. 2, fig. 42.
*Dione æquorea* Con., Amer. Jr. Conch., vol. 1, 1865, p. 6.
*C. æquorea* de Greg., in part, Mon. Faun. Eoc. Ala., 1890, p. 216.

*Conrad's original description.*—Shell subovate, inequilateral, compressed, with regular, distinct concentric sulci; lunule cordiform, two cardinal teeth in the right valve, parallel and approximate. Length 1¾ inches. Breadth 1¼ inch.

Perhaps it is the variability of strength in the lirations that characterizes this species most markedly. When young the liræ may be more or less regular for a time and suggest a relationship with *mortoni*, but the form of the shell is more ovate and less elliptical. When seen from above (pl. 44, fig. 4) this shell appears to have its sides more or less parallel for some distance.

This is by all odds the most abundant species of the genus at Claiborne; *perovata* is moderately abundant, but most of the other forms are rare. We have found nothing in the St. Maurice beds corresponding to this in the Gulf states.

*Type.*—Phila. Acad.

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Locality.*—Claiborne, Ala.

**Meretrix macbeani,** n. sp., Pl. 44. Figs. 8, 9.

*Specific characterization.*—Size and general appearance shown by fig. 8; substance of the shell rather thick; concentric lirations well-defined and smooth; neither escutcheon nor lunule sharply defined; pallial sinus V-shaped; anterior lateral tooth large and strong.

Dimensions of right valve: 21 x 12 x 5.5 mm.

This is but distantly related to any other Cytheroid shell known to the writer from the Eocene of America. In many respects it approaches *Pitaria, s. s.* as defined by Dall.

The *type* specimen (an only one known) is from McBean Creek, Burke Co., Ga., and is in the U. S. Nat. Mus. at Washington. D. C.

## *Nuttali stock*

This common Cytheroid type of shell was well developed into various specific forms in the Midway Eocene. But as the material from that horizon is often not well preserved, the species have not been well defined.

Though the umbonal regions of the representatives may be smooth and shining, there is a tendency to develop corrugations and incised lines basally and anteriorly. The pallial sinus is V-shaped, though often more or less blunted.

*Nuttalliopsis* with several varieties occurs in the upper Sabine of the Gulf states and is represented by *ovata* with var. *pyga* &c in the Virginia Basin.

The vastly extended St. Maurice stage brings out a number of *nuttali*-like forms ; in the Claiborne they reach their maximum in size and differentiation while in the Jackson some *securiformis* varieties become almost indistinguishable from *nuttalliopsis* of the Sabine.

More specifically : While *ovata* in the Virginia basin gives way to *liciata*, *lenis* and *pyga*, *nuttalliopsis* seems to be followed in the Gulf states by *texacola* and its relatives. A moderate-sized shell of this species is shown on pl. 44 as fig. 12 ; and 12 a shows a smaller specimen, in outline, viewed from above. Note the broad development of the umbones and the extent of anterior when compared with *nuttalliopsis.* Auspicious surroundings sometimes seem to have given rise to larger specimens in Texas (fig. 13) while less favored individuals show atavistic and specialized development (pl. 45, figs. 1, 2, 3). The extreme *poulsoni* type was already extant in the eastern St. Maurice stage, likewise forerunners of *nuttali* ; but it was in the Claiborne where these forms attained their most perfect development. *Cornelli* seems to be a less inflated, more *Dosinia*-like and larger form of this same general stock. I have found it only at Claiborne. One valve is in the U. S. Nat. Museum. The type and the one herewith figured are at Cornell.

In the Jackson stage *securiformis* typically is decidedly distinct from *nuttali*, but many are the forms of this species at Montgomery, La., scarcely distinguishable from varieties of *texacola* and *nuttalliopsis*.

*Aequorea* is by far the most abundant at Claiborne. It may be distantly related to the *perovata* stock. *Percrassa*, though thick umbonally, probably belongs with *trigoniata*.

**Meretrix texacola** Harris, Pl. 44, Figs. 13-15.
Pl. 45, Figs. 1 - 3.

*M. texacola* Har., Proc. Phila. Acad. Nat. Sci., 1895, p. 50, pl. 2, fig. 5

*Harris's original description.*—Size and general form as indicated by the figures; surface generally smooth about the umbones, but often more or less corrugated concentrically towards the base, especially posteriorly; lunule in the larger specimens very indistinct, in the smaller forms bordered by a well incised line.

The surface markings somewhat resemble those of *C. nuttalliopsis* Heilp., but the anterior and posterior are too pointed, the shell in general too inflated, and the umbonal angle too great for that species. The larger specimens resemble *M. californica* Con.

Occasional specimens of medium size, referable to this species, seem to practically connect such nearly related forms as *nuttalliopsis*, *nuttali*, and varieties of *securiformis*; hence, in a sense, most of these designations might be regarded as varietal. In Texas, we formerly designated the smaller, longer forms (pl. 45, figs. 2, 3), as var. *tornadonis*. Another Texan form simulating in type of exterior marking the *mortoni* of Conrad is shown by fig. 1. It seems however to be simply a sport from the *texacola* stock.

*Type.*—Texas Museum.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Pl. 44, figs. 13, 14, Tex. Mus. Fig. 12, Lisbon, Ala., C. U. Pal. Mus. Pl. 45, figs. 1-3, Texas State Mus.

*Localities.*—Texas: Rio Grande at Webb-Zapata county line; Smithville, Bastrop Co.; 2 miles E, of Alto, Cherokee;

Mosley's Ferry, Brazos Co.; Cedar Cr., Robertson Co.; Alum Bluff, Trinity River; Hurricane Bayou, Houston Co.; Collier's Ferry, Brazos River, Burleson Co.

Louisiana: Three miles S. E. of Negreet; Simpkins' Place; Clear Lake; Marble Quarry.

Mississippi: Wautubbee.

Alabama: Hamilton Bluff, Lisbon, base of Claiborne.

South Carolina: Center Hill.

North Carolina: Rocky Landing, Neuse River. Var. *nuttali*, 16-17 miles above Newbern, Neuse River, Exp'd. '98.

**Meretrix nuttali** Conrad, Pl. 45, Figs. 4, (5-8 vars.)

*Cytherea Nuttali* Con. Jr. Phila. Acad. Nat. Sci., vol. 6, 1834 p. 149.
*Dione nuttali* Con., Amer. Jour. Conch., vol. 1, 1865, p. 6.

*Conrad's original description.*—Shell subcordate, ventricose, with crowded, elevated acute concentric lines on the inferior portion, obsolete above; beaks prominent; lunule cordate, merely defined by an obscure impressed line; cavity of the umbo capacious.

*Locality.*—Claiborne, Alabama.

This species resembles *C. Poulsoni*, *nobis*, (*C. globosa* Lea) but differs in its striæ and in the beaks which are not so greatly curved forwards. It is smaller than the *Poulsoni*.

Pl. 19, fig. 1 of Harris' Reprint of Conrad's Fossil Shells was doubtless taken from the type specimen of *nuttali* now in the Phila. Acad. collection, though that is a right valve while Conrad's illustration represents both, especially the left. The specimen as illustrated is somewhat emarginate or truncate antero-basally, while our specimens are more regularly ovate, with more pointed pasterior. The lunule is exceedingly indistinctly marked off from the main surface of the valve in this species. Several of our specimens are much larger (50-65 mm.) than Conrad's type, (43 mm.) in fact his specimen was dwarfish and somewhat peculiar. The sharply incised concentric lines, especially basally are very noticeable in this species.

*Type.*—Phila. Acad.

*Horizon.*—Claiborne and St. Maurice (var. forms).

*Specimens figured.*—Claiborne; in C. U. Museum.

*Localities.*—Claiborne, Ala. Neuse River, N. C. ?

**Meretrix cornelli** Harris, Pl. 46, Figs. 1-2

*M. cornelli* Harris. These Bulletins, vol. 1, 1895, p. 49, pl. 1, fig. 5.

*For original characterization*, see the Bulletin referred to above. Of this large and almost *Dosinia*-like species three specimens are known to the writer, one in the U. S. Nat. Museum, collected by L. C. Johnson, and two now at Cornell, including the type, collected by Harris.

All specimens are from the Claiborne "sand."

**Meretrix poulsoni** Conrad, Pl. 46, Figs. 3-5

*Cytherea poulsoni* Con., Foss. Sh. Tert. Form., Aug., 1833, p. 36.
*Dione poulsoni* Con., Amer. Jr. Conch., vol. 1, 1865. p. 6.
*Cytherea poulsoni* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 216, pl. 34, figs. 11-13.

*Conrad's original description.*—Shell ventricose, cordate, with fine concentric striæ ; beaks prominent, curved towards the lunule, which is heart-shaped : cavity of the beaks very deep. Diameter about two inches, the length and breadth being nearly equal.

The beaks are not unlike those of *Isocardia*, and the shell resembles *C. Sayana*, (*nobis*) but the latter wants the concentric striæ. I dedicate this shell to my kind friend, Mr. Charles A. Poulson. *Locality.*—Claiborne, Ala.

This species represents the limiting form of the *nuttali* stock so far as deepening and shortening up of the valves is concerned.

*Type.*—Phila. Acad. Nat. Sci.

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Localities.*—Claiborne, Ala. Certain deep valves from the calcareous sandstones about Newbern, N. C. and Shell Bluff, Ga,. seem to belong to species close to *poulsoni*.

**Meretrix ? vespertina** Conrad, Pl. 46. Fig. 6.

*Venus vespertina* Con., U. S. Mex. Bdy. Surv. Rep., 1857, pt. 2, p. 162, pl. 19, figs. 5, 5 a.

*Conrad's original description.*—Subtriangular, inequilateral, convex ;

length and height equal; buccal end acutely rounded; anal end more obtuse; summit prominent.

A small Eocene species, with the external surface somewhat worn. It appears to have had concentric lines.

*Locality.*—Western Texas.

Nothing in our collection has thus far appeared which could be referred to this small species. Conrad omits it in his Catalogue of Eocene Testacea etc., and Heilprin has overlooked it in his "Eocene Mollusca of the State of Texas". The type specimen, which should be in the collection of the U. S. Nat. Mus., is mislaid or lost. The figure herewith given is after Conrad.

### *Trigoniata stock*

From the Midway *ripleyana* up through the Jackson stage there have appeared representatives of this stock, showing pretty generally a tendency toward a triangular outline, fine and sharply incised growth-lines and a long and comparatively narrow lunule (though the specimens are sometimes very much inflated.)

Perhaps the most characteristic feature of this stock is the tendency to show indications of radiate markings and marginal crenulation. The former are often indistinctly shown on the anterior portion of typical *trigoniata* from Claiborne, while suggestions of marginal crenulation along the anterior basal margin are not rare. These features seem to be rather characteristic of the thicker, perhaps diseased forms.

*Hatchetigbeensis* is unusually circular in outline and the growth-lines tend to concentration, or marginal corrugations.

In the St. Maurice beds there are various close approaches toward typical *trigoniata*. The *bastropensis* of our old MS Texas report is somewhat more circular. While in *winnensis* the outline is roughly triangular, the surface seems usually to show signs of radiating threads, fine marginal crenulations and less even sculpturing concentrically. A variety of this, in which no radii have been seen is excessively globose with microscopic concentric lines on the umbones but with wave-like undulations below. It is moreover less triangular than typical *winnensis*. In the Conradian collection at the Phila. Academy there are two *trigoniata*-like specimens, very thick, with peripheral rugosities, which are probably the ones figured in Harris' Reprint of Conrad's work, pl. 20, fig. 6 and labelled "*subcrassa* Lea". These appear to be the true "*discoidalis*" of Conrad.

Typical *trigoniata* is not very common in the Claiborne sand, but in certain Jacksonian beds in Arkansas is rather abundant, generally the only member of the genus present.

**Meretrix trigoniata** Lea, Pl. 47, Figs. 1-3.

*Cytherea trigoniata* Lea, Cont. to Geol., 1833, p. 67, pl. 2, fig. 44.
*Dione discoidalis* Con., Am. Jr. Conch., vol. 1, 1865, p. 6 (not *C. discoidalis* Con. Foss. Sh. &c.)
*Cytherea trigoniata* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 218, pl. 34, figs. 15-22.

*Lea's original description.*—Shell somewhat inflated, triangular, concentrically and minutely striate, substance of the shell rather thick; beaks moderately elevated and recurved; lunule long, elliptical; teeth moderately large, excavation of the palleal impression deep and rounded; cavity of the shell deep, subangular; margin entire.

Diam. .6, Length .9, Breadth 1.1, of an inch.

In outline the *trigoniata* resembles closely the *subcrassa*. It is, however, less thick in the substance of the shell, has much finer striæ, and is entirely without crenulations on the margin.

We strongly suspect that Conrad's name *discoidalis* has become attached to this species because of his and others' statements making the two synonymous. Lea's figure is what has been at the bottom of the determination of the species.

Conrad's description of *discoidalis* does not tally well with this form. (See Foss. Shells Tert. Form., Aug. 1833. p. 37). Such expressions as "suborbicular", "Inner margin crenulated; lunule cordate, not very distinct, Diameter 1 inch." and the name itself, disc-like: seem to suggest quite a different form. In fact fig. 6 of the proof plate 20, incorporated by Harris in his reprint of Conrad's Fossil Shells seems to represent Conrad's *discoidalis*. Figure 2 styled *discoidalis* should accordingly be labelled *trigoniata* Lea.

De Gregorio pointed out the impropriety of using the name *discoidalis* for this shell and the lack of agreement of Conrad's description with the *trigoniata* of Lea.

This is a middle Eocene species becoming most characteristically developed in the Jackson beds of Arkansas.

*St. Maurice and Claiborne localities.*—Claiborne Bluff, the "sand bed" and the St. Maurice clays at the base of the bluff; Hamilton Bluff, Ala.; Ft. Gaines, Ga.; 5 miles N. of Orangeburg, S. C.

**Meretrix trigoniata** var. **winnensis**, n. var., Pl. 46, Figs. 9-13.

*Varietal differentiation.*—General form somewhat trigonal and very inflated, as shown by the figures; surface with concentric lines and undulations, stronger near the anterior and basal margins, and with exceedingly fine concentric striæ superimposed; apparently when slightly eroded, showing radii crossing the lines of growth at right angles, hence turning upwards posteriorly (*Camptonectes*-like) recalling in this region the markings on some species of *Circe*; as in *trigoniata*, a trace of an obsolete channel radiating from beak to base just anterior to the umbonal ridge; lunule as broad, but shorter than in *trigoniata*; anterior tooth comparatively longer but less pronounced than in *trigoniata*, pallial sinus not deep, pointed; lines of growth not so even, regular and deeply incised as in *trigoniata*; substance of the shell thinner, margin often crenulate; some forms as in figs. 11, 12 and 13 exceedingly inflated, reminding one of *Sphærella*.

In the most inflated forms there is not a trace of radii nor of marginal crenulation but we are inclined to regard this as a minor variation from the typical forms.

The outline of this variety is much more triangular than that of *hatchitigbeensis*, the shell is much thinner and the teeth are different. The globose form, shorter lunule and exterior markings serve to differentiate it from *trigoniata, s. s.*

The specimens we have, though numerous, are all in the form of casts and impressions in a red, fine-grained, hard, sandy matrix, derived evidently from weathering of glauconitic, sandy clays. The exact locality in Winn Parish, Louisiana, from which the material was obtained is not given but it appears to be exactly the same as we have collected along the St. Maurice road leading past the "Marble Quarry" west of Winnfield. Specimens deposited by Harris in the Pal. Museum, Cornell University.

**Meretrix trigoniata** var. **bastropensis**, nov. var., Pl. 47, Figs. 4-6

*Cytherea nuttali* Con., U. S. & Mex. Bound. Surv., Geol. and Paleont. 1857, p. 162, pl. 4, fig. 5.
? *Caryatis exigua* Con., Amer. Jr. Conch., vol, 6, 1871, p. 201, pl. 11, fig. 3.
*Cytherea discoidalis* Heilp., Proc. Acad. Nat. Sci., Phila., 1890, p. 402.
*Cytherea nuttallii* Heilp., *ibid.*
? *Mysia ungulina* Heilp., *ibid.*

*Specific characterization.*—General form as figured : possessing two aspects according to the kind of matrix in which it is preserved: 1st, when preserved in clay or ferruginous sand.—Substance of shell thin ; small ; external surface with beautiful, evenly sculptured concentric striæ ; lunule large, long, defined by a very faintly impressed line ; somewhat resembling *trigoniata* Lea, though too circular in outline (fig. 4). 2d, when preserved in firm calcareous sandstone.—Shell comparatively larger, thicker, with less plainly marked concentric striæ on the umbones and much coarser lines or rugæ near the anterior, basal and posterior margins (fig. 6). This form is very similar to that described by Conrad as *Dosinia alta*, from Canyada de las Uvas, California. The figure he gives is exceedingly poor and misleading. The type specimen, or that marked as such and broken in the manner illustrated, is in the collection of the U. S. National Museum.

This species is generally characterized by the broad, circular form of its posterior margin. The form together with the character of the concentric striæ or rugæ on the larger specimens found along the Rio Grande will serve to differentiate it from *trigoniata* or *nuttali*. In the last mentioned species the rugæ are sharp or lamellar, while in *bastropensis* they are rounded, or semicylindrical. The pallial sinus deeper than in *trigoniata.*

*Type specimens.*—Pl. 47, fig. 4, Mus. No. 407, Sta. 37; fig. 6, No. 1721, Sta. 11. Texas State Museum. Now at the Univ. of Texas.

*Geological horizon.*—St. Maurice Eocene.

*Localities of form No. 1.*—Devil's Eye, Colorado River, Bastrop Co.; Smithville, Bastrop Co.; Mosley's Ferry, Brazos R., Burl. Co.; Brazos R., 500 yards below the mouth of Little Brazos R., Brazos Co.; Cedar Cr., S. E. corner of Wheelock league, Robertson Co.; Campbell Cr., Gifford headright, Robertson Co.; Orrell's Crossing, Elm Cr., Lee Co.

*Localities of form No. 2.*—Rio Grande, six miles above Starr-Zapata Co. line; Rio Grande, Mexican side, one mile above the Starr-Zapata Co. line; Rio Grande, 15 miles below Carrizo; Rio Grande, 6 miles below Carrizo; Dr. Williams' quarry, on Robert Stephenson's headright, Brazos Co.; Hammett's Branch, Louisiana.

**Meretrix subcrassa** Lea, Pl. 46, Fig. 7

*Cytherea subcrassa* Lea, Cont. to Geol., 1833, p. 67, pl. 2, fig. 43.

*Lea's original description.*—Shell somewhat inflated subtriangular, concentrically striate, thick about the region of the hinge; substance of the shell thick: beaks thick and elevated; lunule cordate, indistinct; teeth rather elevated and compressed; excavation of the pallial impression rather small and roundish; cavity of the shell deep and rounded; margin crenulate.

Diam........., Length 1.1, Breadth 1.2 of an inch.

*Observations.*—This shell most resembles *trigoniata* herein described. It is like that shell in outline, but it is thicker, and differs also in having a crenulated margin.

We have found nothing among our Claiborne sand collections showing the extreme thickening of the shell matter shown by Lea's specimens. But we are inclined to believe that when a large enough series of *trigoniata* from the "sand" has been collected, this so-called species will be found to grade imperceptibly into *trigoniata.* Lea evidently did not notice that some *trigoniata* show signs of marginal crenulation. Conrad's *discoidalis* (pl.

46, fig. 8) seems to be an intermediate form.

**"Caryatis exigua"** Conrad, Pl. 47, Fig. 7

*Caryatis exigua* Con., Amer. Jour. Conch., vol. 6, 1871, p. 201, pl. 11, fig. 3.

*Conrad's original description.*—Subcordate, short and elevated, ventricose, thin in substance; summits prominent; posterior side truncated; lunule cordate; indistinctly defined. *Claiborne.* Rare.

We are quite at a loss to know what Conrad had in hand while describing and figuring this so-called species. We have not been able to find the type in the Academy's collections and presume it is lost.

**Meretrix yoakumi** Gabb,

"*? Meretrix yoakumi*" Gabb, Proc. Acad. Nat. Sci., Phila. 1861, p. 370.

*Gabb's original description.*—Shell subquadrate; beaks prominent, placed one-third of the distance from the anterior extremity, which is regularly rounded, posterior cardinal margin straight. Anal extremity subtruncated. Surface marked by numerous very regular concentric ribs, which are abrupt on the side towards the beak, and slope concavely on the other side. Crests of the ribs rounded or subangular. Interspaces a little wider than the ribs.

Length, .3 in.; width, .4; height of valve, .09 in.

From a brown, highly ferruginous sandstone (Eocene), Caddo Peak, Texas. Collected by Prof. Yoakum.

The specimen being so imbedded that I could not obtain a view of the hinge, renders the determination of the genus somewhat doubtful; but since it presents the usual appearance of this genus more strongly than of any other, I refer the species provisionally as above. The shallow valve, the abrupt posterior end, and the very distinct ribs (about thirty in number on the specimen before me), will serve to separate the species from all the other known species.

The type of this species does not seem to be in the collection of the Academy of Natural Sciences of Philadelphia and hence it is doubtless lost. The general form is apparently like that of *bastropensis*, but the number of ribs is obviously far less. The peculiarities in the shape of the ribs are not observable in *bastropensis*. Gabb, moreover, was not sure of the generic position of his specimen; it was small, imperfect and unique. Under such circumstances it seems unwise to attempt to refer the form here described as *bastropensis* to Gabb's *yoakumi*.

**Clementia mercenaroidea** Aldrich, Pl. 47, Figs. 8-11

*Dosinia mercenaroidea* Ald., Jr. Cinn. Soc. Nat. Hist., 1887. p. 82 ; and Bull. Am. Pal. vol. 2, '97, p. 172, pl. 2, fig. 10.
*Meretrix mercenaroidea* Dall, Trans. Wag., III, 1903, p. 1234.

*Aldrich's original description.*—Shell orbicular, moderately compressed, concentrically finely striated, nearly smooth upon the umbo. Substance of the shell thin, thickening towards the margins ; lunule rather long and narrow, beak curved toward the lunule, small and anterior to the center: hinge line rather long. Teeth in left valve rather prominent, erect, central one subtriangular. Ventral margin smooth.

Length, 1.4, Breadth 1.15, Thickness .6 of an inch.

*Locality.*—Upper Landing at base of Claiborne Bluff.

This species is more rotund than the recent *D. concentrica* Gmel. and much thicker through the umbones. Only two specimens found.

This differs from *bastropensis* in form and dentition.

Dall has questioned the propriety of referring this species to *Dosinia* and has suggested that it has a decidedly *Meretrix* appearance. So it would seem, but on examining our specimens we find no trace of an anterior lateral tooth and no trace of either lunule or escutcheon. One usually takes fragments of this shell for *Meretrix trigoniata* for the markings are similar, but the shape of the shell and the hinge characters distinguish the two at once. Most Clementias are thinner, with more weakly developed posterior cardinal and with more ascending pallial sinus. But there was a time when this genus was first differentiating from *Meretrix*-like forms and this species may be the initial result of such a process.

*Type.*—Aldrich Coll., Johns Hopkins Univ.

*Horizon.*—St. Maurice Eocene.

From the base of the bluff just above the "Upper Landing," Claiborne, Ala. 3 miles W. N. W. of Orangeburg, S. C.

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*For illustration of right valve and hinge of left see these Bulletins vol. 2, pl. 2.

**Grateloupia (Cytheriopsis) hydana** Conrad, Pl. 47, Figs. 12, 13

*C. hydana* Con., Foss. Sh. Tert. Form., Aug. 1833, p. 36. Harris' Reprint, pl. 20, fig. 3.
*Gratelupia moulinsi* Lea, Cont. to Geol., 1833, (Dec.) p. 59, pl. 2, fig. 33.
*Cytheriopsis hydana* Con, Am. Jr. Conch., vol. 1, 1865, pp. 7 and 146 ; vol. 3, 1867, p. 14.
*Grateloupia moulinsi* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 221, pl. 34, figs. 28-33.
*Meretrix dalli* Cossm., Notes Compl., 1893, p. 11, pl. 1, figs. 9, 10.
*G.* (*Cyt.*) *hydana* Dall, Trans. Wag., III, 1900, p. 1239.

*Conrad's original description.*—Shell subtriangular, inequilateral ; posterior side slightly channelled ; posterior end cuneiform ; lunule lanceolate, elliptical.

I gladly name this fine species in compliment to Mr. William Hyde, one of the most successful and zealous cultivators of American Conchology. Length 2 inches. Breadth 1½ inches.

*Locality.*—Claiborne, Ala. Cab. Acad. N. S.

I think Dall is correct in referring Cossmann's *dalli* to the young of *hydana*, although it at first seems strange that in the young the posterior should be large and rounded, the anterior acute, while in the adult the reverse is true.

However, by examining small specimens and the umbonal parts of larger ones, one is readily convinced that this change takes place during the growth of the shell. Half-grown shells when nearly equally pointed at either end de Gregorio calls var. *symetrica.*

*Type.*—Phila. Acad. Coll.

*Horizon.*—Claiborne stage.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Locality.*—Claiborne, Ala.

**Gemma sancti-mauricensis**, n. sp., Pl. 47, Figs. 14, 15

*Specific characterization.*—Shell small, somewhat *Astarte*-like exteriorly as figured ; increments of growth well-defined, rounded, becoming much less conspicuous on the anterior and posterior margins which fall off rather abruptly ; lunule rather long, striate, and defined by a faint channel, not a sharply incised line ;

interior porcellanous, giving the shell a slightly thickish appearance for so small a specimen ; anterior adductor scar apparent but not deeply impressed, posterior and pallial sinus excessively faintly defined ; margin faintly crenate anteriorly ; in the right valve (the only one obtained) there is a faint trace of a long posterior lateral tooth, but a corresponding anterior channel, if ever present, is entirely eroded away.

This single specimen was found among some St. Maurice material marked Sabine River ?, La. Its exact provenance is therefore undetermined at present.

At this early date this genus seems not to have developed all the marked characteristics shown later on in the Oligocene and higher beds.

The external ligament was very short. As the shelly matter decayed there was a slight pit-like cavity formed just under the beak, reminding one of the more extensive expansion seen under the beak of *Dosinia*, *Dosiniopsis*, etc.

**Marcia retisculpta** Meyer, Pl. 47, Figs. 16-19

*Venus retisculpta* Meyer, Bull. 1, Geol. Surv. Ala., 1886, p. 84, pl. 1, figs. 27, 27 a.

*Meyer's original description.*—Rhombically circular ; convex ; covered with broad, flat, and somewhat irregular concentric lines, crossed by similar radiating ones ; the sculpture indistinct near the umbo ; an impressed line separates a long lunule ; pallial sinus large ; margin entire.

*Locality.*—Claiborne, Alabama.

The sculpture makes the surface appear as if reticulated with small, rounded holes, especially in worn shells ; the figured specimen shows the complete hinge, otherwise it is not the largest or best sculptured one.

The species is beautifully marked with fine pits concentrically and divaricately arranged. Our two specimens are figured to show the dentition of both valves. This species seems to belong to Cossmann's section *Textivenus*. From the Claiborne sand bed.

**Petricola claibornensis**, n. sp , Pl. 48, Figs. 1, 2

*Specific characterization.*—General appearance as figured ; rather small (15 x 8 x 3.5 mm.); exterior surface with irregular concentric folds and intermittent or discontinuous radial costation most clearly visible anteriorly ; interior with a deep, loop-shaped ascending pallial sinus ; muscular scars large but indistinct ; tooth in the left valve (the only specimen known) well-defined, but probably broken.

This rare species is known from one specimen only, loaned from the U. S. National Museum Collection. From the Claiborne sand, Alabama.

**Trapezium claibornense** Dall, Pl. 48, Figs. 3, 4

*T. claibornense* Dall, Trans. Wag., III, p. 1498, pl. 43, figs. 9, 10. Figure published in 1900, description 1903.

*Dall's original description.*—Shell small, subquadrate, subcompressed, inequilateral, with low, pointed beaks at the anterior third ; anterior end rounded and rather attenuated, the posterior broad and subtruncate; disk covered with rather close, rounded concentric ribbing, obsolete on the umbones ; hinge feeble, the teeth imperfectly developed, the cardinals obscure and the lateral feeble ; the pallial line entire. Length 7.0, height 4.5, diameter 2.0 mm.

This shell is evidently young and only the left valve was obtained. It is, however, evidently a *Trapezium* and of interest as showing the presence of that genus in the Claiborne sands.

Unfortunately the only valve we possess is also the left.

*Type.*—U. S. Nat. Mus.

*Horizon.*—Claiborne Eocene.

*Specimen figured.*—Paleont. Mus. Cornell Univ.

*Locality.*—Claiborne, Ala.

**Coralliophaga (Oryctomya) claibornensis** Dall, Pl. 48, Fig. 5, a

*C. (Oryctomya) claibornensis* Dall, Nautilus, '98, vol. 11, p. 135. Also Trans. Wag., vol. III, 1898, p. 929, pl. 34, figs. 16, a.

*Dall's original description.*—Shell elongate with oval low beaks, quite anterior, moderately inflated, somewhat mesially impressed ; surface with incremental lines which in senile specimens sometimes becomes lamellose near the posterior end ; radial sculpture of rows of small globular granules easily worn off and almost microscopic ; ends rounded, the posterior broader ; hinge teeth delicate, somewhat pedunculate and slender in the adult pallial sinus not extending in front of the posterior adductor scar ; pallial line in senile specimens radially striated.

Lon. 36, alt. 19, diam, 14 mm.

Claiborne sand at Claiborne, Ala. Burns.

This species is readily recognized by its peculiar surface. It is most surprisingly like that shown for *Panopea elongata* (Md. Geol. Surv. Eocene, pl. XXXI, fig. 2 a. (Harris)

So far as we are aware Dall's type is the only specimen known. It is in the U. S. Nat. Museum.

**Psammobia blainvillei** Lea, Pl. 48, Fig. 6

*Solecurtus Blainvillii* Lea, Cont. to Geol., 1833, p. 39, pl. 1, fig. 7.
*Psammobia Blainvillei* Dall, Trans. Wag., III, 1900, p. 959.

*Lea's original description.*—Shell trapezoidal, rather compressed, nearly equilateral, transversely and minutely striate, truncate behind; beaks very small; escutcheon long and deeply impressed; teeth two, the anterior one large and erect, the posterior small and oblique; margin entire.

Diam...... Length .8, Breadth 1.3, inches.

We have seen no other specimen of this species but the type in the Phila. Academy's Collection, No. 5021. It came from the "sand bed" at Claiborne, Ala.

**Psammobia filosa** Conrad, Pl. 48, Fg. 7.

*P. filosa* Con., Foss. Sh. Tert. Form, 1833, p. 42.
*Gari filosa* Con., Amer. Jr. Conch., vol, 1, 1865, p. 4.
*P. filosa* Dall, Trans. Wag., III, 1900, pp. 976 and 977.

*Conrad's original description.*—Shell elongate, with concentric acute striæ, very prominent on the smaller side, which is narrowed and subangulated at the end; beaks not prominent; anterior dorsal margin straight, and the end obtusely rounded; basal margin straight.

Dall says of this species: *P. filosa* Conrad belongs to the section *Garum* of the typical Psammobias. It is elongate and somewhat arcuate; the concentric sculpture pretty close and uniform on the disk, but elevated into low, somewhat broken small laminæ on the posterior dorsal slope; the type is forty-two millimetres long and about fifteen millimetres high. The teeth and pallial sinus are as in *Garum*.

On the same card with Conrad's type in the collection of the Academy of Natural Sciences is another shell thirty-nine millimetres long and seventeen millimetres high, more equilateral, less arcuate, with a blunter and less decurved posterior end and generally straighter dorsal margin. This is probably a distinct species for which I would propose the name of *Psammobia* (*Garum*) *claibornensis*.

The figure herewith given is from a rough pencil sketch of the type made while visiting the Academy some time ago.

We have obtained no specimens of this species nor have we seen any in other collections.

**Psammobia eborea** Conrad, Pl. 48, Figs. 8-11

*P. eborea* Con., Foss, Sh. Tert. Form., 1833, p. 42.
*P.* (*Psammocola*) *eborea* Con. Amer. Jr. Conch., vol. 1, '65, p. 4.
*P. eborea* Dall, Trans. Wag., III, 1900, pp. 976, 978.

*Conrad's original description.*—Shell oblong-oval, compressed ; posterior side longest and obliquely truncated at the end ; dorsal margin straight ; beaks slightly prominent.

Speaking of the incremental ridges in a lower Eocene form of *Psammobia* Dall continues : "The latter often form in *P. eborea* small, sharp, concentric waves dorsally, but not raised laminæ, as in *P. filosa*.

This is very close to *P. ozarkana* Har., (these Bulletins, vol. 2, p. 257, pl. 18, fig. 14, pl. 19, fig. 8) but is less elongate &c as there noted.

This is by no means so rare as the preceding species. There are several specimens at the Philadelphia Academy and our own collection contains three.

*Type.*—Phila. Acad. Nat. Sci.

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—Paleont. Museum Cornell Univ.

*Locality.*—Claiborne, Ala.

**Egerella triangulata** Lea, Pl. 48, Figs. 12, 13

*Egeria triangulata* Lea, Cont. to Geol., 1833, p. 51, pl. 1, fig. 20.
*E. Bucklandii*, *ibid*, p. 52, pl. 1, fig. 21.
*Donax limatula* Con., Foss. Sh. Tert. Form., 1833, p. 42.
*E. donacea* Con., Amer. Jr. Conch., vol. 1, 1865. p. 146, pl. 11, fig. 12.
?*Donax* (*Egerella*) *veneriformis* var. *tiga* de Greg., Mon Faun. Eoc. Ala., 1890, p. 222, pl. 35, figs. 4-9.

*Lea's original description.*—Shell triangular, inequilateral, smooth, obtusely angular before, acutely angular at top, gibbous over the umbo—anterior to which it is flattened; substance of the shell rather thin ; posterior and anterior slopes flattened ; beaks elevated, pointed, incurved ; basal margin emarginate ; cicatrices not perceptible ; cavity of the shell deep in the superior part—of the beak deep and angular ; inferior portion of the margin finely crenulate.

Diam......... Length 1, Breadth 1.2, of an inch.

A single valve of this interesting species has come into my possession. It is the left one. Its beautiful form eminently distinguishes it. The exterior portion of the valve is not perfect, and characters not observed on this specimen may be, perhaps, found on perfect ones.

In Claiborne material there is generally a great number of *Egerella*, with a very few large specimens. We have no intermediate forms. Conrad's thick *donacea* with slightly incurved anterior dorsal margin may be the young of this ; likewise some of deGregorio's *tiga* seem to have the form of the earlier portions of *triangulata*.

*Type.*—No. 5096, Phila. Acad. Coll.

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Locality.*—Claiborne, Ala.

**Egerella subtrigonia** Lea. Pl. 48, Figs. 14-16, a

*Egeria subtrigonia* Lea, Cont. to Geol., 1833, p. 53, pl. 1, fig. 22.
*E. veneriformis* Lea, *ibid*, p. 53, pl. 1, fig. 23.

*Lea's original description.*—Shell subtriangular, somewhat inflated, inequilateral, polished, obtusely angular before and at top ; substance of the shell thin ; anterior slope furnished with a small fold ; beaks slightly elevated, pointed ; cicatrices perceptible ; cavity of the shell rather shallow ; inferior portion of the margin minutely crenulate.

Diam. .2, Length, .3, Breadth .5, of an inch.

There is a very close resemblance between this and the *Bucklandii*, and had there not been so much disparity in the size of the shell and thickness of the valve, I should not have been disposed to separate them. The valves of three specimens are before me. They are of the same size, and have every appearance of being adults.

Regarding *veneriformis* Lea remarks :

This small species has a close resemblance to the last described. It differs chiefly in size and in being more equilateral. It is very common in this stratum.

Lea evidently referred all the small specimens at Claiborne to *veneriformis*, as he had only from one to three valves of the other species. Aside from size, however, it seem that his *subtrigonia* figure most nearly resembles the prevalent type at this locality. However, we have found a specimen or two herewith figured corresponding more nearly to *veneriformis*. It is quite possible that even *triangulata* and *subtrigonia* should be united.

In the anterior and posterior margins of the right valve there are traces of a channelling for the reception of the thin margin of the opposite valve—a beginning of lateral dentition as it were (pl. 48, fig. 16).

*Type.*—No. 5098, Phila. Acad. Coll.

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Locality.*—Claiborne, Ala.

**Tellina tallicheti** Harris, Pl. 49, Figs. 3-5

*T. tallicheti* Har., Proc. Phila. Acad. Nat. Sci., 1865, p. 51, pl. 3, fig. 1.

*Harris' original description.*—Size and general form as indicated by the figure; not twisted posteriorly; thin; posterior sub-biangulate; anterior rounded; beak slightly behind the center; lateral teeth well developed; posterior cardinal bifid; pallial sinus and muscular scars of good dimensions though rather dimly marked; exterior smooth except a few concentric striæ on the post-umbonal slope; umbonal ridge passes from the beak to the postero-basal margin.

*Locality.*—Smithville, Tex.

The diagnosis was based on the right valve only. Fig. 5, pl. 49, shows that in common with *raveneli* there is here, in the left valve, a faint but definite radiating channel in the usual position of the "umbonal ridge". There is sometimes a tendency to show a central flattening of the valves—*Psammobia*-like—but thus far we have observed no radiating lines.

*Type.*—Paleont. Mus. C. U.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus., Cornell Univ.

*Localities.*—Smithville, Texas; Lisbon, Ala.; 6 miles N. W. of Orangeburg, S. C.

**Tellina trumani** var. **australina**, n. var., Pl. 49, Fig. 6, a

*Specific characterization.*—General form more or less elliptical as indicated by the figures; surface marked by fine, rather sharply raised concentric lines; umbonal ridge marked by a low fold extending from the beak to the posterio-basal margin, causing an emargination in the outline; beaks not prominent; dentition rather weak, but of normal elements.

For description and illustrations of *T. trumani* see these Bulletins, vol. 2, p. 265, pls. 18 and 20.

This is of the same stock as *tallicheti*, and the left valve (fig. 5) from Lisbon, Ala., is in a way intermediate between these two species, though more of the form of *tallicheti*. Notice that on that specimen the place (in the left valve) showing a radiating shallow furrow corresponds to the ridge already mentioned in the right valve of the species here under discussion.

We have only the type, the right valve, from the red clay beds of the Orangeburg District, S. C. Now in the Paleontological Museum at Cornell Univ.

**Tellina papyria** Conrad, Pl. 49, Figs. 7-11

*T. papyria* Con., Foss. Sh. Tert. Form., 1833, p. 41.
*T. papyria* Con., Amer. Jr. Sci., vol. 1, 1846, p. 399, pl. 4, fig. 7.
*T. mooreana* Gabb, Jr. Phila. Acad. Nat. Sci., vol. 4, 1860, p. 387, pl. 67, fig. 56.
*T.* (*Peronidia ?*) *papyria* plus *mooreana* Dall, Trans. Wag. III, 1900, p. 1015.

*Conrad's original description.*—Shell elliptical, equilateral, much compressed; extremely thin and fragile, with regular concentric impressed striæ, most distinct on the anterior side; posterior extremity angulated; lunule linear, impressed; beaks not prominent; apex acute; cardinal teeth prominent; lateral teeth none.

The twisting of the posterior, causing the left valve to be deeper than the right might well have been mentioned by Conrad.

So far as the equivalency of *T. papyria* and *mooreana* is concerned, both Conrad's and Gabb's descriptions and figures leave much to be desired, especially Gabb's. His description is simply: "Wide, flattened, nearly equilateral; beaks small, inclined internally; hinge line in advance of the beaks straight; posterior slightly curved; surface smooth or covered only by obsolete lines of growth.

Length .5 in., width .9 in., thickness .2 in.

Caldwell Co., one specimen in my collection."

Gabb's type is in the Academy's collection and from it we were enable to identify fig. 10 of pl. 49. It is just possible that Gabb's *mooreana* when full-grown may be the equivalent of the much heavier types along the Rio Grande.

The more typical *papyria* are found at the base of the Claiborne bluff, though occurring in casts in considerable abundance in the greenish white, hard clays 5 miles N. of Orangeburg, S. C.

*Type.*—Conrad Coll. Acad. Nat. Sci. Phila.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Base of Bluff, Claiborne. Now in Pal. Museum, C. U.

*Localities.*—The so-called *mooreana*: Mosley's Ferry, Cedar Cr.; Little Brazos River, Cherokee Co.; Gonzales Co., Texas.

The more typical *papyria:* Wautubbee, Miss.; Hamilton Bluff, Lisbon, base of Claiborne Bluff, Ala.; 5 miles N. of Orangeburg, S. C.

**Tellina aldrichi** Dall, Pl. 49, Fig. 12

*T.* (*Mœrella?*) *aldrichi* Dall, Trans. Wag., III, 1900, p. 1017, pl. 46, fig. 9.

*Dall's original description.*—Shell large for a *Mœrella*, elongate, with very slight dorsal slopes, rounded in front, arcuate below, and bluntly pointed behind; beaks incurved, pointed, not prominent, posterior end hardly folded; surface smooth, with obsolete concentric undulations and rare radial striulations; lunular region deeply impressed; hinge normal. Lon. 20, alt. 10, semidiam. 2.5 mm.

A single left valve, with the interior inaccessible except the hinge, was sent by Mr. Aldrich with specimens of the *T. papyria*, from which it differs by its elongated slender form, smaller size, and less convex valves. Better specimens from Bell's Landing show a nearly normal hinge with long, low laterals, and an ovate pallial sinus about half confluent below. It is perhaps nearest to *T. greggi* Harris, but that species seems to be smaller, more rounded behind, with the pallial sinus free from the pallial line below.

Eocene of Lisbon, Ala.—Aldrich. Also at Bell's and Gregg's Landings, Ala.

Not having any specimens of this species it is difficult to determine its relationship to the species before described. In outline and horizon it suggests at once *T. subequalis* Con., described from a cast from the Orangeburg District, S. C. (Proc, Phila. Acad. Nat. Sci., 1847, p. 298. Jour. &c, vol. 1. 1848, pl. 14, fig. 8). However, judging from our Orangeburg material, Conrad's *subeqalis* was most probably the internal mold of a specimen of *T. papyria*.

**Tellina cynoglossula**, n. sp., Pl. 49, Figs. 15, 16

*Specific characterization.*—General appearance rather long, narrow, sharply striated and sub-biangulate posteriorly as illustrated ; striæ tending on the earlier portions of the shell to become fewer and stronger on anterior and posterior areas, especially from the umbonal ridge posteriorly ; posterior angulations marked within by low radii (see fig. 16); within, shining, showing pallial sinus but obscurely.

It seems that here we have the continuation of the Sabine *cynoglossa* stock into the Mid-Eocene of the Gulf Coast. *T. linifera* of the Jackson is more pointed. So far as outline is concerned this would seem to be not far from *T. (Mœrella ?) aldrichi* of Dall, but the surface features are very different. Average specimens, about 20 mm. in length have the appearance of those figured ; larger ones, about 30 mm. in length, show an umbonal ridge of a definite width, marked off from the posterior slope by a depressed radiating furrow.

In the compact, sandy clay-rock about Ft. Gaines, belonging to the St. Maurice stage, there are numerous impressions of Tellinas of various shapes and sizes presumably belonging to known species, yet difficult of definite determination. The specimens herewith shown (figs. 13, 14) seem to be very much like *cynoglossula*.

*Types.*—U. S. Nat. Mus.

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—U. S. Nat. Mus.

*Locality.*— Gopher Hill, Wash. Co., Ala.

**Tellina (Angulus) prolenta** Aldrich, Pl. 49, Fig. 17

For Aldrich's original description, see these Bulletins, vol. 5, p. 4, pl. 1, fig. 5.

This author seems to have gotten the ends of the shell reversed in his description.

We have no specimen of this species. Aldrich's type in the Aldrich Collection (Johns Hopkins Univ.?)

**Tellina (Angulus) entænia** Dall, Pl. 50, Fig. 2

*T.* (*Angulus*) *entænia* Dall, Trans. Wag., III, 1900, p. 1016, pl. 46, fig. 2.

*Dall's original description.*—Shell small, rather compressed, solid, elongate, very inequilateral ; beaks low, surface polished, sculptured with faint, little elevated, somewhat irregular concentric lines, which at about the posterior third become suddenly stronger and more prominent, and on the posterior dorsal slope become about half as numerous, somewhat irregular, and still more elevated ; hinge normal, nymph for the ligament short and prominent ; pallial sinus short, rounded in front, reaching a little before the middle of the valve and below about half confluent with the pallial line ; a faint ray behind the anterior adductor scar. Long. 9, alt. 4, semidiameter, 0.8 mm.

Nothing like this interesting little shell has been described from this horizon. Two left valves were obtained. The prominence of the nymph is a general characteristic of the subgenus *Angulus*, though I note in several European publications this feature does not appear to be understood, and there has been a tendency to refer such forms to *Psammobia*, apparently on this character alone.

Eocene of the Claiborne sands at Claiborne, Ala.

N. var. **equator**, Pl. 50, Fig. 1

Larger than the typical form, with nearly equal posterior and anterior parts ; ligament more elongated ; beak more nearly erect.

From the Claiborne sand, Claiborne, Ala. Now in the Paleontological Museum at Cornell.

**Tellina (Angulus) subplana** d'Orb., Pl. 50, Fig. 3

*Egeria plana* Lea, Cont. to Geol., 1833, p. 54, pl.1, fig. 24 (not "25").
*T. subplana* d'Orb., 1850, Prod. Ct. 25, No. 784.
*Tellina plana* Con., Amer. Jr. Sci., 1846, vol, 1, p. 400, pl. 4, fig. 6.
*T.* (*Angulus*) *plana* Dall, Trans. Wag., III, 1900, p. 1016.

*Lea's original description.*—Shell scaleniform, very compressed, transverse, very inequilateral, smooth and shining, furnished with two lamellar lateral teeth ; substance of the shell very thin ; beaks very small and pointed ; cavity of the shell extremely shallow ; margin entire.

Diam. nearly .1, Length .2, Breadth 7-20ths, of an inch.

*Observations.*—Differs from the *ovalis*, which it most resembles, in being smooth, more compressed and more angular.

In No. 1 of this series of Bulletins ('95) I called attention to the fact that Lea's "Fig 24" and "Fig. 25" had been interchanged. Dall has followed this correction, but has failed to note that Gregorio used the species still changed about, as it were. "*Donax plana*" of Gregorio is therefore a synonym of *T. leana* Dall (*ovalis* Lea), and not *T. plana* as Dall states (op. cit. p. 1016).

Cossmann regards *ovalis* and *plana* as synonyms. See footnote p. 9, Notes Complement. &c, 1893.

*Type.*—No. 5139, Lea Coll., Phila. Acad. Nat. Sci.

*Horizon.*—Claiborne Eocene.

*Specimen figured.*—Copy of Lea's figure of type.

*Locality.*—Claiborne, Ala.

**Tellina leana** Dall, Pl. 50, Figs. 4-6

*Egeria ovalis* Lea, Cont. to Geol., 1833, p. 54, pl. 1, fig. 25(not "24").
*Tellina* (*Peronæoderma*) *ovalis* Con., Am. Jr. Conch., vol. 1, 1865, p. 5.
*Donax plana* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 221, pl. 35,

figs. 1-3.
*Tellina* (*Mœrella*) *leana* Dall, Trans. Wag., III, 1900, p. 1015 (not *T. ovalis* Sow., 1825).

*Lea's original description.*—Shell transversely elliptical, compressed, very inequilateral, furnished with two lamellar lateral teeth, covered with minute concentric striæ, which, terminating at the anterior slope, are replaced by larger ones which there interlock, substance of the shell very thin; beaks small and pointed; cavity of the shell very shallow: margin entire.

Diam. .1, Length .2, Breadth .4, of an inch.

*Type.*—No. 5135, Lea Coll., Phila. Acad.

*Horizon.*—Claiborne and St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ. and Texas State Museum.

*Localities.*—Claiborne sand and base of bluff, Claiborne, Ala.

Var. **yeguana**, n. var., Pl. 50, Fig. 7

About one-half the dimension of the typical form; somewhat broader proportionally with a more decurved basal margin; lines very fine, but of the character of *leana*. W. Yegua Cr., Tex.

Var. **sabotica**, n. var., Pl. 50, Figs. 8, 9

Specimens from Keitt's Ravine, S. C., in the U. S. National Museum illustrated herewith, are exceptionally abbreviated posteriorly and pointed anteriorly.

Var. **prægravis**, n. var., Pl. 50, Figs. 10-12

Specimens associated with those mentioned just above, but of much broader outline and thicker, heavier shell.

**Tellina cossmanni** Dall, Pl. 50, Figs. 13-16

*T. nitens* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 223, pl. 35, figs. 13-16.
*T. nitens* Cossm., Notes Compl., 1893, p. 8.
*T. cossmanni* Dall, Trans. Wag., III, 1900, p. 997.

De Gregorio gave the figures herewith copied and a few remarks regarding this form in his famous essay on the Claiborne, in 1890. He states definitely that although Conrad had referred it to *Abra* and *Scrobicularia* and it resembles the *Semele alba* of Wood, "il n'y a pas la petite pouche caractéristique de la charnière."

Cossmann finds this species remarkably close in general appearance to "*Syndesmya tellinula*" (*Abra nitens*) yet this is a *Tellina*. Dall states that the true *nitens* of Lea is an *Abra*, hence this Tellinoid representative is without name ; therefore he suggests *T. cossmanni*.

Dall bases his species on de Gregorio's figures and remarks as well as the statements of Cossmann. He says :

> A small species of *Tellina* of almost identical form [as *A. nitens*] is figured by de Gregorio under this name (pl. 35, figs. 13-16) and Cossmann has supposed that this might have been Lea's species. Lea's specimens however, are of the *Abra*, and the *Tellina*, requiring a new name, might be called *T. cossmanni*. Gregorio's figures erroneously represent the pallial line as entire.

So far as we are aware there are no specimens of this species in American museums.

The types must be regarded as the specimens figured by Gregorio. They are doubtless in his private cabinet.

**Tellina cherokeensis**, n. sp., Pl. 50, Figs. 19, 20

*Specific characterization.*—Broad and of medium size as figured ; with sharply-defined concentric striation over the whole surface, though becoming somewhat coarser basally ; beaks pointed, a little posterior from the middle ; lunule and escutcheon narrow and deeply impressed ; posterior deflected to the right as viewed from the rear ; left valve with a fairly well defined, but low, umbonal ridge, anterior to which is a slight radiating, broad depression and posterior to which is a narrower radiating depression midway of the post-umbonal slope ; right valve with more pronounced umbonal ridge and steeper, somewhat broader post-umbonal slope.

Specimens do not show the interior to any great extent but it is evident that the pallial sinus is very deep and confluent with the line below.

Between the concentric striæ there is often a faint trace of fine radiating threads. In general outline this species is somewhat like *spillmani* Dall (*albaria* Con.), but that is a smoother, thinner, less pointed shell posteriorly. This may have had *cynoglossa* Dall as a remote ancestor.

*Types.*—Paleont. Mus. Cornell Univ.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Locality.*—W. H. Berryman's place, 11 miles from Rusk and 2.5 from Linwood, Cherokee Co., Tex. Collected by A. C. Veatch.

**Macoma scandula** Conrad, Pl. 50, Figs. 17, 18

*T. scandula* Con., Jr. Acad. Nat. Sci., Phila., vol. 7, 1834, p. 132.
*T. scandula* Con., Amer. Jour. Sci., vol. 1, 1846, p. 400, pl. 4, fig. 8.
*Macoma scandula* Dall, Trans. Wag., III, 1900, p. 1016.

*Conrad's best description* (Amer. Jour. Sci.)—Ovate, much compressed; anterior margin rounded; ligament margin very oblique, slightly curved; fold near the posterior margin, angulated, subcarinated; basal margin rounded; beaks scarcely prominent above the hinge line, submedial, nearest the anterior end. Claiborne, Alabama.

I only found one valve, a right one, and this is imperfect; the cardinal plate is broad and thick, with two diverging compressed teeth, and no lateral teeth. The substance of the shell is moderately thick.

We have reproduced Conrad's restoration of this species together with a sketch of our own taken from the type specimen in the Academy's collection.

We naturally presume that Conrad's specimen came from the "Sand Bed", but it may have come from the St. Maurice below. We have found nothing similar in our collections from this locality. That there are many Tellinoid forms in the St. Maurice beds, especially in the so-called Buhrstone, is shown by numerous imprints as at Ft. Gaines and Hamilton Bluff. Some forms from these localities are shown on Pls. 49, 50. It is difficult however, to identify these casts and impressions specifically.

**Tellina alta** Conrad, Pl. 50, Fig. 22

*T. alta* Con., Foss. Sh. Tert. Form., 1833, p. 41.
*T. alta* Con., Amer. Jr. Sci., vol. 1, 1846, p. 399, pl. 4, fig. 10.
*T.* (*Arcopagia*) *alta* Con., Amer. Jour. Conch., 1865, p. 5.
*T.* (*Arcopagia*) *alta* Dall, Trans. Wag. III, 1900, p. 1015.

*Conrad's original description.*—Shell suborbicular or suboval, equilateral, convex, with prominent, acute, concentric striæ, and concave intervening spaces, and with minute radiating lines, lunule small ; lanceolate slightly impressed ; cardinal teeth and anterior lateral tooth compressed and prominent : posterior lateral tooth small but distinct.

In the Journal of 1846, cited above, Conrad modifies his description somewhat as follows : Suborbicular, inequivalved, inequilataral, with lamelliform concentric lines, not closely arranged, and minute closely arranged radiating wrinkles ; posterior side obtusely folded, the inferior margin truncated obliquely inwards ; lateral teeth distinct, the posterior one very short, pyramidal, remote.

In this species one valve is considerably more convex than the other, and the anterior muscular impression is rather deeply impressed, and bounded on the inner side by a broad rib-like elevation, which extends to the apex.

The specimens at the Academy, presumably the types of this species, are much more coarsely striate than is *raveneli*, and are more circular in outline. Whether, however, they are mere extreme variations of the latter from the St. Maurice beds at the base of the bluff or are really representatives of another species from the "sand" above, we are not able to state at present. None of our specimens appear to be clearly referable to this species.

**Tellina raveneli** Conrad, Pl. 51, Figs. 1-5

*T. raveneli* Con., Amer. Jour. Sci., vol. 1, 1846, p. 400.
*T.* (*Arcopagia*) *raveneli* Con., Amer. Jour. Conch., 1865, p. 5.
*T.* (*Arcopagia*) *raveneli* Dall, Trans. Wag., III, 1900, p. 1016.

*Conrad's original description.*—Suboval, inequilateral, moderately thick, with very fine regular concentric lines and with brown bands; anterior margin obliquely truncate above ; posterior side obtusely folded ; beaks a little prominent ; lateral teeth large and prominent, compressed ; area above the anterior lateral tooth dilated.

Of this species I have only an imperfect right valve. Its most remarkable character is the somewhat angulated form of the anterior dorsal margin. Claiborne, Ala.

Though Conrard refers to a pl. 5, fig. 1 in his original diagnosis, it seems never to have been printed. Still, as Dall says, the species is easily determinable. It occurs in considerable abundance in the St. Maurice Eocene at the base of the Upper Bluff at Claiborne, but varies extensively in outline from nearly circular with but a slight flexion of the posterior to more elongately elliptical forms assuming an astonishing similarity in outline to *Semele linosa*. In the higher, older specimens the angle on the anterior dorsal margin, followed below by an oblique truncation seem to be quite characteristic. Some specimens show considerable peripheral areas of well marked concentric lines, though the umbonal regions (as is also the case with *linosa*) are nearly smooth.

In examining the types at the Philadelphia Academy it appears that although there is sometimes an outward resemblance between *T. raveneli* and *S. linosa*, the former has stronger lateral teeth but a less extended pallial sinus.

There are now three specimens in the Conradian collection. The single one labelled *Tellina* (*Arcopagia*) *alta* seems to be Conrad's type of *raveneli*. The two specimens in still another tray labelled *T. alta* are probably the types of that species. They are more striate, less plicate and show a very deep pallial sinus. However, since *raveneli* shows such wide variations it is quite possible that *alta* should be included as a mere variety. These forms seem to be derived from *trumani*.

*Type.*—Phila. Acad. Nat. Sci.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Base of Claiborne Bluff, Ala. ; in Paleont. Museum, C. U.

*Localities.*—Base of Claiborne Bluff, Lisbon, Ala. ; Orangeburg District, S. C.

**Macoma sillimani** Conrad, Pl. 51, Figs. 6, 7

*Tellina sillimani* Con., Amer. Jour. Sci., vol. 1, 1846, p. 399, pl. 4, fig. 9.

*T.* (*Metis ?*) *sillimani* Dall, Trans. Wag., III, 1900, p. 1016.

*Conrad's original description.*—Subtriangular, compressed, thin; left valve with a prominent, acute fold over the umbonial slope, which is straight; posterior side shorter than the anterior; the dorsal line straight and oblique; the end margin obliquely truncated, and the extremity truncated; surface marked with brown concentric bands; valve contracted widely from beak to base between the middle and the umbonial slope. Claiborne, Alabama. Very rare.

We illustrate herewith a specimen that seems to be fairly close to Conrad's type. But the contraction Conrad speaks of between the middle and the umbonal ridge is a very variable feature. Most specimens are without it. This particular specimen is unusually contracted. The specimens without the contraction seem to be very close to *eburneopsis* from the Jacksonian. The umbonal slope is thus characterized: (1st) on the umbonal ridge (right valve) there is an obscurely raised radiating ridge, (2) just behind this an obscure radiating channel, (3) from here to the posterior edge of the valve the area is undifferentiated. In the left valve the position of the fold and channel is reversed.

The posterior of the whole shell is bent somewhat to the right. The brown bands are broad and conspicuous. So far we have observed no lateral teeth.

*Type.*—Phila. Acad.

*Horizon.*—Claiborne Eocene.

*Specimen figured.*—Paleont. Museum Cornell Univ.

*Locality.*—Claiborne, Ala.

**Macoma danai**, n. sp., Pl. 51, Figs. 8, 9

*Specific characterization.*—Shell more or less circular and robust as illustrated; more capacious than *sillimani*, umbonal slope with a radiating fold crossed diagonally by lines of growth, behind which the post-umbonal slope area abruptly faults down, but gradually rises again to the posterior margin; dentition as in *sillimani*; pallial line and sinus confluent below, without the sharply upraised sub-sinus just beneath the umbo shown in *silli-*

*mani.*

Dimensions of each valve : 52 x 43 x 12 mm.

*Type.*—Paleont. Mus. C. U.

*Horizon.*—Claiborne Eocene.

*Specimen figured.*—Paleont. Mus. Cornell Univ.

*Locality.*—Claiborne, Ala.

**Semele linosa** Conrad, Pl. 52, Figs. 1-3

*Amphidesma linosa* Con., Foss. Sh. Tert. Form., 1833, p. 42.
*A. linosa* Con., Amer. Jr. Sci., 1846, vol, 1, p. 397, pl. 4, fig. 2.
*Semele linosa* Con., Amer. Jour. Conch., vol. 1, 1865, p. 5.
*A. linosa* Harris, Reprint. Conrad &c, 1893, pl. 19, fig. 13.
*S. linosa* Dall, Trans. Wag., III, 1900, p. 986.

*Conrad's best characterization* (Amer. Jour. Sci.).—Ovate, plano-convex with fine regular, concentric prominent lines ; right valve with a somewhat prominent obtuse fold over the umbonial slope, the base of which is emarginate ; posterior side short ; extremity subtruncated or very obtusely rounded, direct ; beaks slightly prominent ; fosset produced, elliptical. Claiborne, Alabama.

I have only two valves of this species, which much resemble a *Tellina* exteriorly. The pallial sinus is very profound. In the right valve are two diverging compressed cardinal teeth, and the lateral teeth are very distinct.

This occurs in the St. Maurice beds at the base of Claiborne cliff and at Lisbon in connection with *Tellina raveneli*, some specimens of which it resembles very closely. This is especially the case when the latter become elongate and show considerable areas with strongly raised, concentric lines. However, if one can get at the hinge structure there need be no doubt as to which of these two species a specimen should be referred. Most modern Semeles have much more broadly developed and shorter internal ligament than does this species. Again the external ligament is unusually long in this species.

*Type.*—Conradian Coll., Phila. Acad. Nat. Sci.

The specimens here used are all from the base of the Claiborne bluff, in St. Maurice deposits, and are now deposited in the Paleontological Museum at Cornell.

Smaller, more finely striate specimens are in our collections from the Orangeburg District, S. C., and Ft. Gaines, Ga. It occurs in the Jackson at Montgomery, Ala.

**Semele linosa**, var. **claibornensis**, n. var., Pl. 52, Figs. 4, a

*Semele profunda* Dall, Trans. Wag., III, 1900, p. 986. Dall's specimen, but not Conrad's figure.

This little specimen, (8.5 x 6.4 v 1.5 mm) labelled "*S. profunda ?*" seems to be a weak, senile representative of the well characterized *linosa* of the St. Maurice stage. Its concentric lines are evident anterio-basally but seem never to have been well developed posteriorly.

The specimen figured, the only one known, is from the Claiborne sand, Claiborne, Ala., and was borrowed for figuring from the National Museum, No. 129,548.

**Semele linosa**, var., Pl. 52, fig. 5, a

Specimen from Keitt's Ravine. S. C., having a broad, *Abra*-like aspect. U. S. Nat. Museum specimen.

**Semele linosa**, var., Pl. 52, Fig. 6

Specimen 6.5 mm. in length, having something of the aspects of both *claibornensis*, var., and *T. australina*.

**Semele profunda** Conrad, Pl. 52, Figs. 7, 8

*Amphidesma profunda* Con. Name mentioned, p. 8. App. Mort. Synop. Org. Rem., 1834.
*A. profunda* Con., Pl. 19, fig. 14, Harris' Reprint, Con. Foss. Shells, &c, 1893.

Although this species has never been described, the figure given on the plate above referred to is quite sufficient for its identification. The name *profunda*, too, is exceptionally well chosen. We have but one valve of this rare species, the one herewith figured ; but if two valves were placed in normal position the diameter of the shell would be at least two-thirds the height. Certain small *Cumingiæ* have somewhat the proportions of this species ; yet upon the whole it seems best placed with *Semele*, though lateral teeth are scarcely perceptible. The pit for the internal ligament is deep and well-developed ; the exterior ligamental groove is of moderate length and size.

Conrad seems to have forgotten this species in his list of 1865.

The muscular scars can just be made out, but the pallial line and sinus seem not to have been impressed in the least.

We obtained our one valve from the Claiborne "sand", Claiborne, Ala.

**Semele australina,** n. ap., Pl. 52, Figs. 9, a, b

*Specific characterization.*—Shell ellipso-quadrate as indicated by the figures ; surface practically smooth with a few impressed, distant growth lines ; posterior radiate plication and sulcation as in *Tellina raveneli* and *Semele linosa* ; valves shallow in comparison with *S. profunda*, hinge much more delicate ; the ligament is separated from the resilium by the strong shell margin; just in front of the resilium is a weak oblique tooth, still in advance is a stronger tooth before which is a pit (see pl. 52, fig. 9 a.).

The above description applies to the left valve, the only one thus far known in perfect condition.

A large smooth specimen from the Rio Grande, (probably belonging to this species) is figured herewith (fig. 10).

The smooth surface, sharp, deep, posterior fold and sinus, and the semi-quadrangular form serve to distinguish this species at once from Conrad's *linosa*, from the same horizon.

*Type.*—Paleont. Mus. C. U. (From Orangeburg District, S. C.)

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Figs. 9, a b, Orangeburg District, S. C. Fig. 10, 15 miles below Carrizo Cr., Rio Grande, Tex.

**Abra nitens** Lea, Pl. 52, Figs. 11-13

*Egeria nitens* Lea, Cont. to Geol., 1833, p. 51, pl.1, fig. 19.
*Amphidesma tellinula* Con., Amer. Jr. Sci., vol. 1, 1846, p. 397, pl. 4, fig. 5.
*Abra nitens tellinula* Con., Am. Jr. Conch., vol. 1, 1865, p. 5.
*Tellina nitens* Grego., *pars*, Mon. Faun. Eoc. Ala., 1890, p. 223.
*Syndesmya tellinula* Cossm., Notes Compl., 1893, p. 8, pl. 1, figs. 7, 8.
*Abra nitens* Dall, Trans. Wag., III, 1900, p. 997.

*Lea's original description.*—Shell subelliptical, obliquely transverse, inequilateral, the anterior portion being much the larger, rather compressed, smooth and shining; substance of the shell very thin; posterior slope lightly folded; beaks elevated, pointed; cicatrices scarcely perceptible; cavity of the shell not deep, of the beaks rather deep; margn entire.

Diam. .1, Length 5-20, Breadth 6-20ths, of an inch.

At first view this species might be taken for the *inflata*. On examination it will be easily distinguished by its polish, its obliquity, and particularly the great disparity of the size of the anterior portion of the shell, the *inflata* being nearly equilateral.

This species varies considerably in outline as may be seen by examining the figures herewith given.

*Type.*— Phila. Acad. Nat. Sci., Nos. 5092 and 5093.

We have seen this species only from the Claiborne sand at Claiborne, Ala.

**Cumingia ? keittensis**, n. sp., Pl. 52, Figs. 14, 15
Pl. 53, Fig. 1

*Specific characterization.*—Form somewhat angular-ellipsioidal as illustrated; substance of shell moderately thick, surface in general marked by well-defined concentric striæ, anterior strongly characterized by down-dipping, curved, *Strigilla*-like unconformable ridges; posterior area more or less marked off from the general shell surface by an umbonal ridge; teeth (so far as can be determined by the left valve) showing one strong cardinal tooth, posterior to which is a longer lamelliform, radiating tooth which bounds the resilium pit anteriorly; pit bounded behind, not very sharply, by a slight radiating ridge above which a sharp diagonal gash indicates the position of a submerged ligament; posterior lateral faint, short; anterior lateral short, at distal termination of lunular area; lunule narrow, cordiform, deeply sunken under the beak; escutcheon not sharply defined.

The true generic position of this remarkable form we can only determine after better material, showing teeth of both valves and pallial sinus, has been collected.

*Types.*—U. S. Nat. Mus.

*Horizon.*—Probably St. Maurice

*Specimens figured.*—The types.

*Locality.*—Sta. 4589, "Keitt Ravine, 4.5 miles N. W. of Creston, Orangeburg Co., S. C."

**Ervilia meyeri** Aldrich, Pl. 52, Fig. 16

*Ervilia meyeri* Aldr., these Bulletins, vol. 5, 1917, p. 5, pl. 1, fig. 7.

For Aldrich's original description, see the above mentioned volume.

So far we have found no sample of this minute form. Aldrich cites it from the Claiborne sand on the Tombigbee.

**Spisula parilis** Conrad, Pl. 53, Figs. 2-4

*Mactra parilis* Con., Foss. Sh. Tert. Form, 1833, p. 42 ; pl. 19, fig. 8 of Harris' Reprint.
*M. pygmæa* Lea, Cont. to Geol., 1833, p. 44, pl. 1, fig. 11.
*M. parilis* Con., Amer. Jour. Sci., vol. 1, 1846, p. 217, pl. 2, fig. 6.
*M. ? parilis* Con., Amer. Jour. Conch., vol. 1, 1865, p. 3.
*M.* (*Cyrena ?*) *parilis* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 227, pl. 36, figs. 1-9.
*M. parilis* Cossmann, Notes Compl., 1893, p. 8.
*Spisula parilis* Dall, Trans. Wag., III, 1895, p. 896.

*Conrad's best characterization* (Amer. Jr. Sci.).—Triangular, equilateral, smooth and polished ; both ends depressed and striated ; umbonial slope slightly folded ; anterior angle with an impressed line ; cavity capacious.

Claiborne, Alabama.

This species has some resemblance in outline to the *M. lateralis* of Say, but its specific character is very different.

Upon re-inspecting our Sabine material it is evident that our var. *bistriata* formerly referred (Bull. Am. Pal., II, '97, p. 258, pl. 19, fig. 10) to *prætenuis* and afterwards (Geol. Surv. La., '99, p. 503, pl. 53, fig. 4) designated as a disticnt species, is really very closely allied to *parilis* Con., though not so inflated nor so erect, but of double the size of this latter species. In the Jackson at Jackson, Miss., the small, rugged specimens are very erect and angular.

*Type.*—Phila. Acad. Nat. Sci. (Conradian Coll.)

*Horizon.*—Claiborne, St. Maurice and ? Sabine.

*Specimens figured.*—From Claiborne sand. Now at Cornell.

*Localities.*—Claiborne and Lisbon (as var. *bistriata*), Ala. ; Wautubbee, Miss. ; also Hammett's Branch, La.

**Spisula prætenuis** Conrad, Pl, 53, Figs. 5-8

*Mactra prætenuis* Con., Foss. Sh. Tert. Form., 1833, p. 42, pl. 19, fig. 9 of Harris' Reprint.
*M. prætenuis* Con., Amer. Jour. Sci., vol. 1, 1846, p. 217, pl. 2, fig. 4.
*Mactrella prætenuis* Con., Amer. Jour. Conch., 1865, p. 4.
*Spisula prætenuis* Dall, Trans. Wag. III, 1895, p. 896.

*Conrad's best description* (Amer. Jour. Sci.).—Subtriangular, compressed, equilateral, thin and fragile, umbonial slope submarginal, subrectilinear, carinated ; beaks slightly prominent : posterior slope with two prominent fine lines and obliquely rugose ; surface of the valves with very minute concentric closely arranged lines. Claiborne, Ala.

This shell is very rare. It has somewhat the outline of *M. delumbis*, of the Miocene, but is a much smaller and very distinct species. It has the cardinal fissure which would constitute it a member of the genus *Scissodesma.*

Conrad's illustrations show a somewhat longer or more *delumbis*-like form than the usual specimens from the "sand" at Claiborne. The Orangeburg specimens are not quite so sharply carinate and are thicker accordingly than the typical Claibornian (var. *australina*, n. var., pl. 53, figs. 9-12).

*Type.*—Phila. Acad.

*Horizon.*—Jackson, Claiborne and St. Maurice Eocene.

*Specimens figured.*—From Claiborne and Orangeburg, now in the Paleont. Museum at Cornell.

*Localities.*—Claiborne sand, Claiborne, Ala. ; three to six miles N. of Orangeburg, (more or less silicified specimens in ferruginous clay), S. C. ; specimens here are fairly abundant. Ft.

Gaines, Ga. ; Montgomery, La. (Jackson).

**Spisula decisa** Conrad, Pl. 54, Fig. 1

*Mactra decisa* Con., Foss, Sh. Tert. Form., 1833, 42.
*M. decisa* Con., Amer. Jour. Sci., vol. 1, 1846, p. 216, pl. 2, fig. 3.
*Spisula decisa* Dall, Trans. Wag., III, 1895, p. 896.

*Conrad's best characterization* (Amer. Jour. Sci.).—Triangular, ventricose, umbonial slope angular, slightly carinated, posterior slope depressed, with a line somewhat bifid or double from beak to base, and short oblique prominent lines on the upper portion of the valves ; cardinal fosset large and profound, the anterior tooth adjoining it triangular, with a deep pit on each of the three sides. Claiborne, Ala.

This very rare species has not been found entire. I have only one fragment, and the hinge of this is perfect enough to exhibit the fissure in the hinge line under the apex, which characterizes the genus *Scissodesma*.

We have little hesitation in referring the fragment we have of a hinge line to this species though the umbonal slope can scarcely be described as "carinated", nor do we quite understand "the fissure in the hinge line".

*Type.*—A mere fragment in the Phila. Acad. Conradian Collection.

Our specimen is likewise from the Claiborne sand and is now at Cornell.

**Spisula decisa** var. **palmaris**, n. var., Pl. 54, Figs. 2-6

With such fragmentary material at hand it is difficult to decide whether the typical *decisa* from the Claiborne sand should be classed as one and the same species with the St. Maurice material. The Claiborne sand fragments indicate a very deep shell cavity, and show a large, robust beak, very tightly incurving and somewhat twisted. The St. Maurice specimens show a more pointed and erect beak with seemingly a slightly less capacious shell cavity. We seriously doubt the propriety in uniting these differently appearing forms without calling attention to certain well-marked differences.

Under var. *palmaris*, accordingly, we would place the internal casts and molds from the base of the Claiborne bluff, such as shown by figs. 2 and 3, as well as similar forms from 5 miles N. of Orangeburg, S. C. The angulate and thinner shelled forms from Keitt's Ravine (figs. 4-6) may be placed here for the present.

**Mactropsis æquorea** Conrad, Pl. 54, Figs. 7-9

*Erycina æquorea* Con., Foss. Sh. Tert. Form., 1833, p. 42 ; pl. 19, fig. 11 of Harris' Reprint.
*Mactra grayi* Lea, Cont. to Geol., 1833, p. 42, pl. 1, fig. 10.
*Triquetra æquorea* Con., Amer. Jr. Sci., vol, 1, 1846, p. 218, pl. 2, fig. 5.
*Mactropsis æquorea* Con., Proc. Phila. Acad. Nat. Sci., 1854, p. 30.
*Mactropsis æquorea* Con., Amer. Jour. Conch., 1865, p. 5.
*Mactropsis æquorea* Dall, Trans. Wag., III, 1895, p. 911.

*Conrad's best characterization* (Amer. Jour. Sci.).—Triangular, equilateral, thick, plano-convex ; umbonial slope submarginal, angulated ; umbo flattened, apex acute ; anterior extremity acutely rounded ; posterior extremity obliquely truncated ; cardinal plate very thick ; fossett small, ovate ; cardinal plate thickest under the anterior cardinal tooth.

Claiborne, Alabama.

A common species, the valves of which are always found separated. The substance of the shell is remarkably thick.

This is one of the very common lesser bivalves in the Claiborne "sand" at Claiborne. We have as yet found it from no other horizon.

*Type.*—Phila. Acad. Nat. Sci.

*Specimens figured.*—Paleont. Mus., Cornell Univ.

**Mactropsis rectilinearis** Conrad, Pl. 54, Figs. 10-12

*Erycina rectilinearis* Con., Foss. Sh. Tert. Form., 1833, p. 42 ; pl. 19, fig. 10 of Harris' Reprint.
*Triquetra rectilinearis* Con., Amer. Jr. Sci., vol. 1, 1846, p. 218, pl. 2, fig. 8.
*Mactropsis rectilinearis* Con., Amer. Jour. Conch., 1865, p. 5.
*Mactropsis rectilinearis* Dall, Trans. Wag., III, 1895, p. 911.

*Conrad's best characterication* (Amer. Jour. Sci.).—Triangular, flattened above, with coarse lines of growth ; posterior side subcuneiform, rather longer than the anterior side, extremity subtruncated ; umbo much flattened, apex acute ; posterior dorsal margin rectilinear ; basal margin a little tumid near the middle. Claiborne, Ala.

This shell is larger, thinner, more inequilateral than the preceding [*æquorea*], and very rare. The cardinal plate is less thickened and the anterior muscular impression not so deeply impressed. Both species have an indistinct impressed line on the exterior, extending from the anterior end to the apex.

This is indeed a rare species but is so much thinner than *æquorea* and with so much wider hinge area that a comparatively fragmentary specimen can be quickly differentiated from specimens of the latter species. Our specimens were from the famous Claiborne "sand bed".

**Pteropsis papyria** Conrad, Pl. 54, Fig. 13, a

*Lutraria papyria* Con., Foss. Sh. Tert. Form., 1833, p. 41 ; pl. 19, fig. 7, Harris' Reprint.
*Mactra dentata* Lea, Cont. to Geol., 1833, p. 41, pl. 1, fig. 9.
*L. papyria* Con., Amer. Jour. Sci., vol. 1, 1846, p. 216, pl. 1, fig. 8.
*Pteropsis papyria* Gabb, Jour. Phila. A. N. S., vol. 4, 1860, p. 296.
*Pteropsis papyria* Dall, Trans. Wag., III, 1895, p. 881.

*Conrad's best characterization* (Amer. Jour. Sci.).—Ovate, very thin and fragile, inflated anteriorly ; surface with concentric sulci, profound on the sides and obsolete in the middle, and with numerous interrupted wrinkled lines from umbo to base ; anterior end abruptly rounded ; posterior side cuneiform, compressed, gaping ; a slight fold, and nearer the end margin, an undulated line from beak to base ; submargin angular, with a narrow depressed area at the extremity of the valves. Claiborne, Alabama.

A very rare species and exceedingly fragile. I have only one valve nearly perfect and the fragment of another. The teeth and cardinal grooves are remarkably large and profound.

Small fragments of shells belonging to this species are not so very rare in the Claiborne sand bed, but we have succeeded in finding no really good specimens that would stand packing and shipment. So far as we are aware it is found only in the sand at Claiborne, Ala.

There are now two nearly perfect left valves in the Conradian collection at the Phila. Academy.

**Pteropsis lapidosa** Conrad, Pl. 54, Figs. 14-15

*Lutraria lapidosa* Con., Amer. Jour. Sci., vol. 1, 1846, p. 215, pl. 1, fig. 7.

*Astarte conradi* Dana, Man'l Geol., 1863, p. 516. fig. 800.

*Lutraria conradi* Ald., Bull. 1, Geol. Surv. Ala., 1886, p. 39, pl. 4, fig. 7.

*Pteropsis lapidosa* Dall, Trans. Wag., III, 1895, p. 881.

*Conrad's description.*—Obliquely ovate, convex, with rather distinct large concentric sulci, obsolete towards the base; summits very elevated, from which the anterior and posterior dorsal margins decline very obliquely; anterior extremity angulated; posterior side cuneiform towards the end margin, which is acutely rounded or subangulated; anterior basal margin very oblique, subtruncated. Orangeburg, S. C.

I have but one specimen, a cast in indurated clay, without a trace of the original shell remaining upon it.

This species possesses a very thin, fragile shell, and, when embedded in marly clay is apt to be much distorted. As Aldrich says (loc. cit): The one fiugred by Prof. Dana has been considerably distorted by pressure, and therefore mislead Prof. Heilprin, who considered it a young *Crassatella alta*.

While writing my Texas MS report on the Tertiaries of that State I had the opportunity of comparing the type of *P. conradi* with *lapidosa* and found that they most probably were of one and the same species, as Aldrich had intimated. Dall unhesitatingly refers *conradi* to *lapidosa*. In this he is doubtless correct. Conrad's type and description of *lapidosa* are incomplete in lacking the pouting lunular area. Distortion causes the shell to assume all sorts of outline. Strangely enough, probably through a mental confusion, the Philadelphia types are labelled *petrosa* instead of *lapidosa*.

*Type.*—Philadelphia Academy, Nat. Sci.

*Horizon.*—St. Maurice Eocene.

*Specimen figured.*—Orangeburg District, S. C. Specimen in Paleont. Laboratory, Cornell Univ.

*Localities.*—Texas: Campbell's and Cedar Creek, Robertson Co. La.: Near Red Land, Bossier Parish; Gibsland; Chautauqua; Hammett's Branch. Miss.: 4 miles W. of Enterprise; Wautubbee. Ala.: Coffeeville, Lisbon, base of Claiborne Bluff. S. C.: Orangeburg District; Center Hill.

**Periploma claibornensis** Lea, Pl. 55, Fig. 1

*Anatina claibornensis* Lea, Cont. to Geol., 1833, p. 40, pl. 1, fig. 8.

*Lea's original description.*—A portion of the hinge only of this shell has come under my notice, consisting of the apophysis, the point of the beak, and a small part of the dorsal margin behind the beak. The apophysis is elliptical, and small comparatively with the thickness of the valve in the region. The figure is a good representation of the part described, and it will be observed that the substance of the shell is much thicker than any described species. The pearly nacre which distinguishes most of the genus is very observable in this.

We have two specimens like Lea's but showing nothing further in regard to the nature of this species or its relationship to the various forms from the St. Maurice beds below. The type of No. 5023 is still in the Academy's collection, Philadelphia, Pa.

**Periploma collardi** Harris, Pl. 55, Figs. 2-5

*P. collardi* Har., Proc. Phila. Acad. Nat. Sci., 1895, p. 52, pl. 3, fig. 4.
*P. collardi* Dall, Trans. Wag., III, 1903, p. 1528.

*Harris' original characterization.*—General form as figured; nearly equivalve; beaks turned slightly backward, posterior deflected to the right; substance of the shell thin and very nacreous; umbones fissured. The general form of this species is somewhat like that of *Ceronia singleyi*, from which, however, it is distinguished by the difference in direction of the beaks, as well as by the beaks themselves. Again this species has a much more extended posterior dorsal margin.

The type specimen was from Dr. Collard's farm, Sparks Headright, Brazos Co., Texas. It is more elongate than the specimens from the base of the bluff at Claiborne from the same horizon. Those from St. Maurice, La., show an intermediate outline usually, though the elongate, Texan form occurs. Some at the base of the Claiborne bluff after having been probably distorted by pressure assume a nearly circular outline and are considerably inflated. But what seems to be the prevalent form here is shown by fig. 3. Fig. 5 shows very beautiful radiate structure to good advantage. All these specimens are thin shelled and highly nacreous.

In the Orangeburg District, S. C., a variety or distinct species is much thicker, nearly circular, flat and *Lucina*-like in aspect. The semi-silicified condition of the shell may have obliterated the original nacre of this form, but the various other differences make it worth while to call this at least a new variety *australina* (figs. 6-8). It is the first mid-Eocene specimen described from the Gulf region to show general form and markings of exterior and the characteristice interior.

It is not unlikely that, as Dall suggests, Lea's *claibornensis* is the same as other Eocene forms since described. But of this fact we still have no proof. This offers a splendid instance of the poor policy of giving specific names to mere fragments of shells. Lea's figure is sufficient to show that the genus occurs in the Claiborne sand but it shows nothing else.

*Type of collardi.*—Texas Univ. Museum.

*Type of australina.*—Cornell Univ. Pal. Museum.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—The type from Texas, intermediate forms from the base of Claiborne bluff ; the type of *australina* from the Orangeburg District, S. C.

*Localities.*—As above; also at St. Maurice, La.

**Verticordia (Haliris) mississippiensis** Dall, Pl. 55, Fig. 9

*V.* (*H.*) *mississippiensis* Dall, Trans. Wag., III, 1900, p. 1198, pl. 42, fig. 1, p. 1510.

*Dall's original description.*—Shell rounded, triangular, inflated, with very high involute prosocœlous beaks ; sculpture with about thirty-three narrow, angular radial ribs, uniformly distributed and with about equal interspaces, the entire surface closely and minutely granulose ; the granules are more or less arranged in radial lines ; basal margin arcuate, produced towards the middle, serrate by the sculpture, nymphs strong ; interior brilliantly pearly and very much disposed to scale off.

Lon. 5.5, alt, 5.0, diam. about 6 mm.

This shell, external, looks like a minute *Pecchiolia*. The pearly substance is so friable that it is hardly safe to attempt to describe the hinge, all the specimens being more or less defective. There is no lunule. The shell is much heavier than the Bowden species and more pearly.

Eocene of the Wautubbee Hills, Clark Co., Miss. ; Burns.

Our collection have afforded no specimen of this interesting form.

**Verticordia eocensis** Langdon, Pl. 55, Figs. 13-16

*V. eocensis* Langdon, Amer. Jour. Sci., vol. 41, 1886, p. 208. Pl. 6, fig. 13, Ala. Geol. Surv., Bull. 1.—Aldrich.

Not *V. eocœnensis* Cossmann, Notes Compl., 1893, p. 7, pl. 1, fig. 6 from Jackson, Miss.

*V. eocenensis* Dall, *partim*, Trans. Wag., III, 1903, p. 1510.

*Langdon's original description.*—Shell rotund, beak recurved, elevated and striate, substance of the shell rather thick, lunule obscure, one prominent cardinal tooth, lateral teeth oblique, margin dentate and crenulated between dentitions ; nacre brilliantly pearly ; muscular impressions two, profound ; pallial line obscure ; closely ribbed ; ribs about 16, crenulate, radiating regularly from the beak and slightly recurved.

Length .25, Breadth .25, Height .06.

This, I believe, is the first *Verticordia* described from the Eocene, there having been only three species known among living and fossil shells, two of these being Miocene. Differs from *V. emmonsi* Con., in being rotund and having more ribs, and from *V. cardiiformis* Wood in having no striations between the ribs, in being more rotund, and showing no incurving of the ribs as they approach the ventral margin.

Claiborne, Ala., and Jackson, Miss.

In the typical form *eocensis* there is not much abrupt variation in the spacing or size of the ribs. However, a little irregularity is noticeable in about the third or fourth from the posterior margin.

In our specimens from Hickory and the Sabine River, from the St. Maurice horizon, the tendency to irregularity becomes more noticeable. There are three posterior ribs, then a rather broad space, then two ribs slightly closer together followed by about eleven quite evenly spaced.

In the form described by Aldrich as *sotoensis* (The Nautilus, vol. 16, 1902, p. 100, pl. 4, figs. 19-21) there are two posterior ribs, then a space, anterior to which there are twelve ribs (see pl. 55, figs. 10-12).

For the reader's convenience we here include Aldrich's description of *sotoensis* :

> Shell small, strongly ribbed with twelve ribs, then a blank space, then two ribs near the margin, beaks blunt and rounded, ventral margin serrated ; internal tooth long and curved. Interior very porcellaneous ; muscular scars slightly impressed.

*Localities.*—Claibornian of De Soto and McLeod's Mill, Miss., and in Western Alabama, same horizon.

This species closely resembles *V. dalliana, nobis,* but differs in the number of ribs and the absence of one space which appears on the other. It is also more rounded.

With *sotoensis* as a name for the rather marked variety just referred to its seems unnecessary to give a special name to the intermediate forms from Hickory and the Sabine.

It is quite possible that the *Verticordia* we figured from the Midway Eocene (these Bulletins, vol. 1, pl. 16, fig. 16) some years ago without naming it, should be referred to a variety of *eocensis.* But we have no connecting forms as yet from the Sabine stage. Aldrich's *dalliana* seems to be a modification of *sotoensis,* found in somewhat higher Eocene or Oligocene beds.

Of this species Dall has well remarked : "This belongs to the typical section of the group and has from thirteen to sixteen ribs, a minutely granulose surface, moderately convex valves, and is well figured by Aldrich as above noted. The inter-spaces between the ribs usually show one or two impressed lines radiating in harmony with the ribs. The pallial line has a distinct but shallow sinuation."

*Type.*—

*Horizon.*—St. Maurice and Claibornian ; possibly also Midway to Jackson.

*Specimens figured.*—Paleont. Mus. Cornell Univ. Others copied from Aldrich.

*Localities.*—Sabine River, Tex., opposite S. W. cor. S. E. ¼ sect. 35, 13 W., 5 N.—Veatch.

Hickory, Miss. Claiborne sand bed, Claiborne, Ala.

**Cuspidaria prima** var. **multiornata** Ald. & Mr., Pl. 55, Figs. 18-20

*Neæra (Cardiomya) multiornata* Ald., & Mr., Cinn. Soc. Nat. Hist., vol. 9, pt. 2, 1886, p. 46, pl. 11, fig. 19.

For Aldrich's description of *prima,* see these Bulletins, vol. 2, p. 266, pl. 20, fig. 14.

Aldrich and Meyer's description of *multiornata* reads as follows :

Posterior half of the surface, with six radiating ribs, the stronger the more posterior they are. They alternate with smaller radiating ribs, which do not cover the umbonial part. Anterior half of the surface covered with numerous radiating ribs ; its umbonial part is covered by strong concentric ribs, which terminate abruptly at the first radiating rib of the posterior half. Wautubbee.

We believe *multiornata* and *prima* have been regarded as very distinct and figured so on account of the very few specimens known. There seems to be no definite number of strong ribs posteriorly nor is the anterior without indications of ribs. Again, the secondary, inter-ribbing, varies in strength.

It is evident that the figured type of *multiornata* is only a fragment of the umbonal part and does not show the outline correctly at all if it is really a *Cardiomya*. See fig. 19 for a photo of a specimen from the type locality and fig. 20 for a fragment of the same species from St. Maurice with more strongly differentiated sculpturing anteriorly and posteriorly. In this the four posterior radii are strongly marked while the anterior is weakly marked.

**Cuspidaria attenuata** Aldrich, Pl, 55, Fig. 21

*Neæra alternata* Ald., Bull. 1, Geol. Surv. Ala., 1886, p. 38, (pl. 6, fig. 15, as *attenuata*, *lapsus pennæ*).
*C. attenuata*Dall, Trans. Wag., III, 1903, p. 1505.

*Aldrich's original description.*—Shell small, moderately rotund, covered with very fine concentric lines ; rostrum short, obtuse, rounded on top and angulated on dorsal margin ; lines of growth becoming lamellar on its surface. Hinge line and dorsal line of rostrum straight. Cartilage pit minute, narrow, oblique and close under the beak.

*Locality.*—Lisbon, Ala.

We have found no specimens corresponding to this description. In outline and marking it is wonderfully like some of the Buhrstone Ledas.

Since the name *alternata* is preoccupied for this genus by d'Orbigny's species, Dall proposes, quite properly, to make use of Aldrich's name, accidentally used on the explanation of the plate, for this species.

## CORBULA

### *Alabamiensis stock*

The majority of the specimens, seemingly of this stock, in the upper Sabine at Woods Bluff are of the small, strongly concentrically striate, laterally flattened, compressed form (pl. 56, figs. 1-4, 7) already described in vol. 2 of these Bulletins (p. 260, *subengonata* Dall). These, slightly more specialized in the Claiborne sand, constitute the variety *ima* of Gregorio. Still, among these are some (figs. 5, 6,8) pointing towards typical *alabaminensis*. The latter occur sparingly in rather smallish individuals in the St. Maurice stage from Texas to the Carolinas. Along with them in this horizon occur specimens, quite inflated, with finer concentric striation, for the most part lacking the strong umbonal carination of the species generally, in fact, reminding one of some rather weakly marked *Cuspidaria* (var. *citronella*, figs. 12, 13). This type, after becòming a little more rostrate in the Claiborne, appears to be Cossmann's variety *Gregorioi* (figs. 14-16) though he refers the variety to *compressa*, Lea.

In the Claiborne sand, so called, this stock riots in forms and numbers. Most conspicuous are the large, nasute specimens giving rise to Conrad's name *nasuta* (figs. 22-26). But others shorten, become thick and elevated, and show in adult forms a noticeable geniculation medially (figs. 26-30). These, var. *tecla* of Gregorio, are approaching close to the Jacksonian *densata* ; in fact Dall has it that they really are *densata*. Typical *densata* (figs. 31-31), is a somewhat more elevated form.

**Corbula alabamiensis** Lea, with varieties, Pl. 56

*C. alabamiensis* Lea, Cont. to Geol., 1833, p. 45, pl. 1, fig. 12.
*C. nasuta* Con., Foss. Sh. Tert. Form., 1833, p. 38. See also pl. 19, fig. 4 of Harris' Reprint.
*C. subnasuta* d'Orb., Prod., 382.
*C. nasuta* Gregorio, Mon. Faun. Eoc. Ala., 1890, p. 231, pls. 36-38.
*C. alabamiensis* Cossmann, Notes Supl., 1893, p. 6.
*C. alabamiensis* Dall, Trans. Wag., III, 1898, p. 841.

For Lea's original description, see these Bulletins, vol. 2,

p. 260.

We have no hesitation in using Lea's name *alabamiensis* instead of Conrad's *nasuta* since, although the latter was proposed first, it was already preoccupied by Sowerby's species and again, Conrad's description, without figure, does not define the species.

Plate 56 shows what appears to be the development of this fecund stock from the Sabine, through the St. Maurice, Claiborne and Jackson horizons. Some of the flatter, coarsely and horizontally marked earlier forms that linger along into the Claiborne stage would certainly be regarded as perfectly distinct species were there not so many intermediate forms connecting them with the typical specimens. They instinctively remind one of *engonata* of the Vicksburg Oligocene but lack the beautiful microscopic radii of that species in the Claibornian, though their predecessors do show such markings.

The left valve of the typical form is apt to be shorter than the right while both show lines of growth that seem to dip or plunge posteriorly (figs. 17, 19) and both show a fairly strong umbonal ridge. There are sometimes traces of two grooves on the post-umbonal slope (fig. 28), and in some varieties there are well-marked, fine radii over considerable portions of the shell. The rather small, smoother and thinner specimens with very extended rostrum in the Claibornian (var. *gregorioi*, figs. 14, 15) are preceded in the St. Maurice beds by shorter, somewhat more strongly striate forms (var. *citronella*, figs. 12, 13) from the Orangeburg District. The *densata*-like forms are apt to show a marked geniculation as indicated in profile by fig. 28 and the post-umbonal grooves are obvious and the lines of growth seem nearly horizontal. The umbonal ridge, however is strongly and sharply defined.

Dall refers Conrad's *nasuta* of the Mexican Boundary Survey (1857, pl. 19, fig. 4) to a new species which he calls *conradi*. What we have seen of Western Texas material inclines us to believe that what Conrad really had was a somewhat elevated form of *alabamiensis*, a mere modification of a type like the one he figured on pl. 19, fig. 4 of Harris' Reprint of Fossil Shells, &c.

*Type.*—Type of right valve, No. 5039 of the Phila. Acad.

Coll. Left valve perhaps 5040, more probably Lea's figure, was from a reversed tracing of 5039.

*Horizon.*—Typically Claibornian, but represented by mutations in beds ranging from the Sabine to the Jackson inclusive.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Localities.*—On the Rio Grande, 2 miles above San Jose and at Webb-Zapata Co. line ; on the Colorado River at Smithville and at the mouth of Alum Creek ; Brazos River, Mosley's Ferry, 500 yds below the mouth of Little Brazos ; Cedar Creek and Campbell's Creek, Robertson Co., Texas ; Sabine River, La. ; Hickory ; 8 miles W. of Enterprise ; Wautubbee, Miss. Lisbon ; Claiborne Bluff, Ala. ; 3 and 6 miles N. W. of Orangeburg, and 5 miles N. of Orangeburg, S. C. ; Ft. Gaines, Ga.

**Corbula compressa** Lea, Pl. 57, Figs. 1-6

*C. compressa* Lea, *partim*, Cont. to Geol., 1833, p. 47, pl. 1, fig. 15.
*C. perdubia* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 233, pl. 36, figs. 31-32.
*C. compressa* and *perdubia* Cossm., Notes Compl., 1893, p. 6.

*Lea's original description.*—Shell triangular-ovate, compressed, equilateral, inequivalve, concentrically and finely striate on both valves ; beaks slightly elevated, incurved ; umbonial slope with a double carina on the right valve, and a single one on the left ; cicatrices not distinctly marked ; cavity of the beaks shallow.

Diam .1, Length .2, Breadth 5-20 of an inch.

*Observations.*—Not easily confounded with the preceding species, [*gibbosa*] being smaller and having both valves similarly striate.

There is considerable doubt in the mind of the writer as to what name should be applied to this very small species of *Corbula* at Claiborne. Lea's types as preserved in the Academy's collections contained a mixture of *compressa*, as we understand the term, *murchisoni*, and *alabamiensis*. His figured specimen we fear is but a mutation of *alabamiensis* and the dimensions he assigns for the "breadth" of the specimen is quite too large for our species. The name too, *compressa*, for adult forms is quite misleading, in fact contradictory, it would seem, to the expression "*umbonial slope with a double carina on the right valve*". Yet his "observations" show he had in mind a small species quite distinct from all others, and his types include this among others, so we are inclined to adopt the name *compressa* for this particular species. De Gregorio illustrates well the young stage of this species (as *perdubia*) but he too indicates that its size is too great.

When specimens are young there is generally a flatness, a broadness of posterior, a forward curving of the beak reminding one (when viewed under the microscope) of *Venus rileyi*. The valves are not distinctly dissimilar when young. The senile stage, not often represented, shows a thickening, a geniculating medially, an increase in regularity and strength of the growth lines, a sharpening of the posterior sub-margin and a channel on the post-umbonal slope (shown best on decorticated specimens.)

We strongly suspect that Dall had in hand some representatives of this species along with others and classed them as *C.* (*Cuneocorbula*) *gregorioi* (Trans. Wag. III, p. 843) in 1895. He regards our *smithvillensis* as synonymous with *gregorioi*. His interpretation of *perdubia* (op. cit. p. 844) is not clear, owing to lack of illustrations and to the fact that three-fourths of his "Jackson Eocene" localities are really St. Maurice.

*Type.*—Phila. Acad. Coll.

*Horizon.*—Claiborne Eocene.

*Specimens figured.*—Paleont. Museum Cornell Univ.

*Locality.*—Claiborne, (sand bed) Ala.

**Corbula smithvillensis** Harris, Pl, 57, Figs. 10-17

*C. aldrichi* var. *smithvillensis* Har., Proc. Phila. Acad. Nat. Sci., 1895, p. 52, pl. 3, fig. 5, a.

*C. rugosa* Heilp., non Lam., Proc. Phila. Acad. Nat. Sci., 1890, p. 401.

*C.* (*Cuneocorbula*) *gregorioi* Dall, non Cossm., Trans. Wag., III, 1895, p. 843.

*Harris' original characterization.*—The variety is larger than the typical form, the beak in the left valve more nearly central ; right valve proportionally higher ; radiating lines generally obsolete.

It is very difficult for the present writer to undersand how Heilprin could have confounded this form with *rugosa* Lam. or how Dall could have regarded it as Cossmann's *gregorioi*.

The umbones of the valves in *smithvillensis* are generally smooth ; the strong concentric liration begins medially or basally, generally. But in *rugosa* it is the earliest stage of the left valve that shows lirations, while below the shell is generally smooth. It is also longish and has the aspect of the left valve of the *murchisoni* stock. The rotund, short, left valve of *smithvillensis* is scarcely to be distinguished from the left valve of *aldrichi*. The radiating lines of the latter species, however, are generally wanting. The illustrations on pl. 57 show these various characters. As already stated, *gregorioi* seems to be an inflated, nasute *alabamiensis* if Cossmann's figure is at all correct.

The type of *smithvillensis* was rather unusually large and smooth as published in the Proc. Phila. Acad., as noted above. Corrugations are apt to cover a greater portion of the shell. There is always something of an umbonal ridge, but in many Louisiana specimens it is not at all prominent. Some remarkably large, senile, right valves of *compressa* have the outline and superficial resemblance to dwarfed right valves of *smithvillensis*. But the umbonal regions show marked differences : *compressa* shows there a flattening, a well-defined concentric striation, and a longish form approaching in characteristics its own left valve, while *smithvillensis* is nearly smooth, nearly round, inflated, or semispherical. Some older right valves of *smithvillensis*, if unusually high and rugose, bear a striking resemblance to the Jacksonian *wailesiana*. One has only to glance at the respective left valves to see that the two species are very far apart genetically.

*Type*.—Texas State Museum.

*Horizon*.—St. Maurice Eocene.

*Specimens figured*.—Paleont. Mus. Cornell Univ.

*Localities*.—Smithville, Bastrop Co. ; Burleson Shell Bluff on Brazos River ; 2 miles E. of Alto, Cherokee Co., Mosley's Ferry, Brazos River ; Cedar Creek, Wheelock League. Robertson C. ; Elm Creek, Robertson Co. ; Berryman's Land, Cherokee Co. ; Alum Bluff, Trinity River, Houston Co., 2 miles S. of Mt. Selman P. O. ; 1 mile N. of Nevilles, Gonzales Co. ; 15 miles S. E. of Nacodoches, Nacodoches Co. ; Tex. Sabine

River ; Mt. Lebanon, Winnfield (1000 feet deep in well), La. Near Enterprise, Miss.

**Corbula texana** Gabb, Pl. 57, Figs. 24-28

*C. texana* Gabb, Jour. Phila. Acad. Nat. Sci., 2d Ser., vol. 4, p. 386, pl. 67, fig. 54.
*C. texana* Dall, Trans. Wag., III, pt. 4, p. 845, 1898.

*Gabb's original description.*—Inflated, subtriangnlar, thick, umbones large ; right valve marked by numerous large transverse ribs ; umbonal slopes rather abrupt ; basal margin regularly rounded ; left valve ?

Dimensions.—Length .3 in., width .38 in., depth of right valve .15 in. Common. I have seen numerous specimens of the right valve but none of the left.

The left valve is considerably smaller than the right, nearly smooth ; long-quadrangular in outline ; marked by two or sometimes three folds radiating from the beak.

This species seems but distantly related to any other American Eocene type. A few of its markings recall *murchisoni*, but it is only half the dimensions of that species, its right valve has nothing of the characteristic, even lirations of the latter having only fine lines and great irregular breaks in the exterior surface. Both valves are very much shallower than in *murchisoni*. On the left valve, however, there are very distinct radiating folds : on *murchisoni* these must be viewed in the right light, oftentimes, in order to be seen at all. This is preeminently a Texan Mid-Eocene form flourishing in the midst of the richest molluscan faunas.

*Corbula rugosa* Lam., of the Paris Basin resembles this, somewhat, but is more regular in surface markings, more nasute posteriorly, and larger.

*Type.*—Lost. Duplicates in Phila. Acad. Mus.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

*Localities.*—Mosley's Ferry and Cedar Cr., Burleson Co. ; A. Kimble headright, Cherokee Co. ; Sabine river, opp. S. 35, 5 N., 13 W.

**Corbula gibbosa** Lea, Pl. 58, Figs. 1-6

*C. gibbosa* Lea, Cont. to Geol., p. 46, pl. 1, fig. 14, 1833.
*C. oniscus* Con. (*partim*) Amer. Jour. Sci., vol. 1, p. 398. pl. 4, fig. 3.
*C. ignota* de Greg., Mon. Faun. Eoc. Ala., p. 232, pl. 37, figs. 14-18. Left valve only.
*C. gibbosa* de Greg., *idem*, p. 233, pl. 36, figs. 27-28 and 29-30? (Right valve only).
*C. gibbosa* Har., Bull. Am. Pal., vol. 1 p. 20, 1895.

*Lea's original description.*—Shell very transverse, somewhat inflated, nearly equilateral, very inequivalve, on the right valve transversely and distinctly striate, on the left valve transversely and minutely striate; beaks elevated, incurved; umbonial slope with a double carina on the right valve, and on the left a single carina and indistinct fold. Cicatrices not distinctly marked; cavity of the beak rather deep.

Diam. .2 Length .3 Breadth .5 of an inch.

Observation.—This species has some resemblance to the *murchisoni*, but differs in being more transverse, in being more produced behind, in having a more obtuse carina, and in being less inflated,

While at first there may seem to be a little superficial resemblance between this species and *murchisoni*, especially in the heavy liration over the surface of the right valve, no one could well confound specimens of the left valves of the two species.

The illustrations herewith given show how very distinct the forms are.

Conrad included not only *murchisoni* but *gibbosa* and even the Jacksonian species from the Ouachita River, La., under his *oniscus*.

*Type.*—Of right valve, 5063, of left 5064 of the Phila. Acad. Coll.

*Horizon.*—Claiborne sand.

*Specimens figured.*—Paleont. Mus. Cornell Univ.

**Corbula murchisoni** Lea, Pl. 58, Figs. 7-10, 12-15

*C. oniscus* Con., Amer. Jr. Sci., Jan. 1833, vol, 23, p. 341; *idem*, '46, vol. 1, p. 398, (*partim*) *non* pl. 4, fig. 3.
*C. murchisoni* Lea, Cont. to Geol., Dec. 1833, p. 46, pl. 1, fig. 13.
*C. murchisoni* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 231, pl. 37, figs. 22-39, pl. 38, figs. 1-13.
*C. murchisoni* Cossm., Ann. Geol. et Pal., 1893, p. 6.
*C. oniscus* Dall, (*partim*), Wag. Inst. Sci., III, pt. 4, 1898, p. 843.

*Lea's original description.*—Shell much inflated, triangular, subbiangulate behind, nearly equilateral, very inequivalve ; right valve covered with regular, large transverse ribs, which terminate at the sharp carina or the umbonial slope ; left valve smooth or slightly wrinkled, with two or three obscure ribs passing from the beak to the basal margin, and a linear umbonial slope, posterior to which there is a deep fold ; beaks very large and incurved ; tooth and pit of the left valve large ; posterior slope truncated, furnished with a double carina on the right valve and a single carina fold on the left. Cicatrices not distinctly impressed ; cavities of beaks very deep.

Diam. .3, Length .5, Breadth .6, of an inch.

We prefer Lea's name for this species, for, though Conrad's description was given a few months earlier, it does not differentiate this form *gibbosa ;* in fact Conrad's figure in 1846 as cited above is doubtless *gibbosa.* As late as 1865 (Am. Jr. Conch., vol. 1, p. 3) Conrad fails to discriminate these two very well characterized species.

This is the most conspicuous of the Claiborne sand Corbulas. We have seen it from no other horizon, but Dall records it both from the Sabine below and the Jackson above. This author is correct in regarding Gregorio's *C. ignota* as simply the smooth left valve of another species, but is evidently wrong in referring it to *murchisoni.* For the many figures of *murchisoni*, (both valves are given by Gregario) show plainly he knew the species well. On the other hand, Gregorio's remarks (p. 233) and figures show he was entirely at a loss to know what the left valve of *gibbosa* was like. His figures of *ignota* are left valves of *gibbosa* Lea.

This species differs from the *C. wailesiana* Har. of the Jackson Eocene by its coarser lirations, and more acute biangulation posteriorly in the right valve ; more contracted posterior in left valve. However, *wailesiana* is clearly a direct derivative of *murchisoni.*

It is interesting to note that while in a very young state the two valves are similar in size and marking (fig. 12). Adult conditions setting in (generally abruptly), the left valve becomes nearly smooth, shows faint radiating undulations and furrows on the post-umbonal slope ; while the right valve assumes the inflated, very corrugate form so well known in this species. Occasionally the early shell cleaves off ; sometimes the exterior of the great right valve scales away, leaving a strange looking, smooth specimen.

*Type.*—Lea's figured types seem to be those we have catalogued as 5061 and 5062 in the Phila. Acad. Coll.

*Horizon.*—Claiborne sand.

*Locality.*—Claiborne, Ala.

**Corbula murchisoni** var. **fossata**, Meyer & Ald. Pl. 58, Figs. 11, 16-20

*C. murchisoni* var. *fossata* Meyer and Aldrich, Jr. Cinn. Soc. Nat. Hist., vol. 9, p. 45. pl. 2, fig. 22, 1886.
*C. fossata* Dall, Trans. Wag., III, p. 844, 1898.

*Meyer and Aldrich's original description.*—Like *Corbula murchisoni* Lea, from Claiborne, but the concentric ribs terminate rather abruptly at a depressed line along the carina. Between this line and the carina there are double the number of small concentric ribs. The form, besides, is smaller than in Claiborne.

Newton, Wautubbee; Lisbon, Ala.

The type specimen is from Newton. The sharp and well defined depression along the carina of the umbonial slope is so striking and seems to be so characteristic for the horizon, Newton-Wautubbee-Lisbon, that some might consider it more practical to give to the form a new specific name. This however would not show its close relation to *Corb. murchisoni.*

Dall seems to regard this as a separate species and adds Vaughan's locality, Mt. Lebanon, La.

We now hesitate to follow the same course for there are now and then to be found in the Claiborne sand, specimens of *murchisoni* of transitional form, some even quite typical *fossata* as shown by fig. 11.

*Type.*—Johns Hopkins Univ. Mus.

*Horizon.*—St. Maurice and occasionally Claiborne.

*Specimens figured.*—Mus. Cornell Univ.

*Localities.*—Mt. Lebanon, La. Johnson's place ; 8 miles W. of Enterprise ; Hickory ; Newton ; Wautubbee, Miss. Claiborne, Ala.

**Corbula extenuata** Dall, Pl. 58, Figs. 21-27

*Corbula* (*fossata* var. ?) *extenuata* Dall, Trans. Wag., III, p. 844. pl. 36, fig. 6.

Dall defines this form in the following terms : "This differs from *fossata* by being less high and more elongated, with two very strong keels on the rostrum, the end of which is emarginate between them ; the anterior keel projects below the ventral margin of the rest of the valve, with an emargination in front of it ; the rostrum is produced, recurved, and sculptured as in *fossata* ; the beaks are small, pointed and incurved; the left valve is smooth and very turgid. Long. 8, alt. 6, diam. of right valve 3.3 mm."

We are led to believe this is far enough from *fossata* to be regarded as a distinct species, not only on account of the length of the right valve, but especially the greater length of the left valve (see figs. 25-27) though this seems not to be quite in harmony with Dall's diagnosis. The species differs from the *fossata* type very much as *gibbosa* differs from *murchisoni*.

*Type.*—U. S. Nat. Mus.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Paleont. Mus., Cornell Univ.

*Locality.*—Orangeburg, S. C. (3-6 miles W. N. W.).

**Panopea porrectoides** Aldrich, Pl. 59, Fig. 1

*P. porrectoides* Aldr., Geol. Surv. Ala., No. 1, 1886, p. 37 pl. 4, fig.3.

*Aldrich's original description.*—Shell thin, oblong, ventricose ; surface marked by lines of growth ; anterior side expanded, posterior produced. Ventral margin nearly straight. Beaks incurved, pointed, wrinkled by lines of growth. The posterior end widely gaping, and has a wedge-shaped appearance. Tooth strong, blunt below, sharp above ; hinge line short.

*Locality.*—Baker's Bluff, Ala. ; Ferr. sand bed.

The differences between this form and the Miocene *P. porrectoides* Con., are very slight.

We have no specimens of this species from the Claibornian stage ; but have fine casts of the interior of somewhat broader, larger specimens from the silicious limestone rock above Newbern on the Neuse River. It certainly has a very Miocenic aspect.

**Solen lisbonensis** Aldrich, Pl. 59, Fig. 2

*S. lisbonensis* Ald., Geol. Surv. Ala. Bull., No. 1, 1886, p. 37, pl. 4, fig. 4.
*S.* (*Plectosolen*) *lisbonensis* Dall, Trans. Wag. III, 1900, p. 953.

*Aldrich's original description.*—Shell linear, nearly straight; posterior sub-truncate; anterior obliquely rounded with a depressed space behind running to the beaks; lines of growth prominent, bending at right angles along a line running obliquely from the beaks to the junction of the posterior and ventral margins. Anterior widely gaping. Lisbon, Ala., just above the Buhrstone.

Especially common in Buhrstone at Ft. Gaines, Ga.

To this species Dall has added a variety, *op. cit.*, called *abruptus*, characterized as follows: This form, represented by numerous fragments, differs from Aldrich's figure by its more abrupt anterior truncation and relatively wider valves. It will probably, when more complete specimens are obtained, prove to belong to a distinct species. *Locality.*—Clark Co., Miss.

**Cultellus (Ensiculus) conradi** Cossmann, Pl. 59, Fig. 3

*Ensiculus conradi* Cossmann, Notes Supl., 1894, p. 5, pl. 1, fig. 1.
*Cultellus* (*E.*) *conradi* Dall, Trans. Wag., III, 1900, p. 958.

*Cossmann's original description.*—Testa depressiuscula, antice abbreviata ac subovalis, postice elongata et elatior; umbones parvi, haud prominuli; cardo cum dente antico perpendiculari et dente postice sub marginem paralleli, cicatricula musculi anterioris, angusta, prælonga, atque radiatim impressa.

Coquille déprimée, court, rétrécie et ovale de coté antérior plus dilatée et allongée du coté postérieur; le bord supérieur parait rectiligne, les crotchets très petits et à peine courbés en avant, n'y font aucune saillie. Toute la surface est lisse, avec de faibles stries d'accroissement qui indiquent bien la contour de la coquille complète, sur le seul fragment que je possède. La charnière de la valve droite se compose d'une dent antérieure étroite et saillante, presque perpendiculaire au bord cardinal, tandisque la dent postérieure forme un bourrelet parallèle au bord. L'impression du muscle adducteur est étroite et allongée: elle prend naissance contre la callosité du rebord antérieur et s'étend obliquement vers le coté anal. marqué de petits rayons peu saillants.

Longeur du fragment 7 mill. ; largeur 4 mill.

Cette espèce très intéressante se distingue de *E. cladarus* du bassin de Paris, par son bord cardinal plus rectiligne et par sa dent antérieure plus allongée ; l'impression musculaire prend naissance plus près du bord antérieur, comme dans le genre *Cultellus*, mais elle s'étend obliquement comme celle *d'Ensiculus cladarus*, quoiqu'elle soit moins près de la charnière. Claiborne, ma collection.

Dall remarks regarding this species: "Specimens of this small species have been obtained by Burns and Johnson, but mostly in a fragmentary condition. It is easily recognized by the curved ridge in front of the anterior scar.

There are no specimens of this species worthy of illustration in our collections.

**Siliqua simondsi** Harris, Pl. 59, Fig. 4

*S. simondsi* Harris, Proc. Phila. Acad. Nat. Sci., 1895, p. 51, pl. 3, fig. 2.
*S. simondsi* Dall, Trans. Wag., III, 1900, p. 956.

*Harris' original description.*—Size and general form as indicated by the figure ; anterior acutely rounded sub-basally, posterior rounded ; from the umbo radiate two depressions (in the cast), the anterior deep, the posterior more nearly vertical and faint ; pallial line and sinus comparatively well marked.

*Type.*—Texas State Museum.

*Horizon.*—Jackson ? Eocene.

*Locality of only specimen known.*—Dr. Williams' Quarry, Stephenson's Headright, Brazos Co., Texas.

More material must be collected before the generic position of this species can be definitely determined.

**Martesia texana** Harris, Pl. 59, Fig. 5

*M. texana* Har., Proc. Phila. Acad, Nat. Sci., 1895, p. 53, pl. 3, fig. 6.
*M. texana* Dall, Trans. Wag., III, 1895, p. 820.

*Harris' original description.*—General form as figured ; surface marked by concentric lines or corrugations crossed by a radiating fold ; anterior to this the lines are strong, but behind it they are very faint.

This speceis differs from *M. elongata* Ald., by its much greater anterior development, and hence the much more central position of the radiating fold.

*Type.*—The Texas State Mus. Coll.

*Horizon.*—St. Maurice Eocene.

*Locality.*—Two miles east of Alto, Cherokee Co., Tex.

**Phladomya claibornensis** Aldrich, Pl. 59, Figs. 6 10

*P. claibornensis* Ald., Geol. Surv. Ala., Bull. 1, 1886, p. 38, pl. 4, fig. 5.

*P. claibornensis* Dall, Trans. Wag.. III, 1903, p. 1531.

*Aldrich's original description.*—Shell exceedingly thin, pearly, concentrically ribbed, crossed by radial lines, which are strong on the umbones ; beak high, very prominent close to the anterior end of the shell, anterior truncated abruptly ; posterier produced, flattened on the upper part ; lunule long and narrow, smooth ; hinge raised, prominent.

This shell, as already pointed out by Dall, assumes very different aspects in accordances with the pressure it has been subjected to in the enclosing beds. Perhaps we get the best conception of its form in specimens preserved in hard, clay ironstone as at St. Maurice, La., where it is quite abundant.

*Type.*—Aldrich Coll., Johns Hopkins Univ.

*Horizon.*—St. Maurice Eocene.

*Specimens figured.*—Texas State Museum, No. 452 and Cornell Univ.

*Localities.*—Texas :Theree miles N. E. of Crockett, Rusk Road, Houston Co. ; two miles E. of Alto, Cherokee Co. Louisiana : St. Maurice, mouth of Saline Bayou. Alabama : base of of bluff, Claiborne ; Lisbon.

**Gastroceæna larva** Conrad, Pl. 59, Figs. 11, 12

*Fistulana larva* Con., Amer. Jr. Sci., vol. 1, 1846, p. 212, pl. 1, fig. 5.

*Gastrochæna larva* Con., Amer. Jour. Conch., vol. 1, 1865, p. 2.

*Gastrochæna larva* Ald., These Bulletins, vol. 1, 1885, p. 71, pl. 6, fig. 12.

*Conrad's original description.*—Ovate-oblong, ventricose ; thin and fragile ; anterior margin short, straight, very oblique ; extremity angulated ; posterior margin regularly rounded ; umbonial slope defined by impressed lines ; concentric lines on the anterior half of the shell rough and prominent, basal margin slightly arched.

Claiborne, Alabama.

This rare species is allied to *F. elongata* Desh., but is proportionally shorter and very distinct.

The very much broken type is still in the Conradian Eocene Collection at the Phila. Academy.

**Xylophaga ? mississippiensis** Meyer, Pl. 59, Fig. 13

*X. ? mississippiensis* Mr., Cinn. Soc. Nat. Hist., vol. 9, pt. 2, 1886, p. 46, pl. 2, fig. 24.

*Meyer's original description.*—Globular, widely gaping in front. Divided by a radiating line into two parts. The posterior part is convex and covered by indistinct, distant concentric lines. The anterior part is globularly rounded and covered by sharp, elevated, somewhat waving concentric ribs, smaller and crowded on the umbonial part. Its anterior margin is reflected.

Newton.

One single specimen has been found.

In our collections there are no traces of this species.

**Gastrochæna** sp., Pl. 59, Figs. 14, 15

*Gastrochæna* sp., Meyer, Ber. ueber die Senck'b,. nat. Gesell. in Frankf. a. M., 1887, p. 12, pl. 2, figs. 10, a.

Meyer remarks regarding this form : "The burrow herewith illustrated I regard as belonging to a *Gastrochæna*. Fig. 11 a [10 a] ? shows the opening enlarged. Deshayes figures a seemingly similar tube as belonging to *Gastrochæna ampullaria* Lam.

"Conrad has described from Claiborne a *Gastrochæna larva*. Besides, I have had a specimen of another species from Claiborne in my collection for a long time named *Gastrochæna subbipartita*, n. sp. It is characterized like *Gastrochæna bipartita* Wat. by an umbonal furrow dividing it into two parts. I have not illustrated the species as it is possible better material may be obtained."

We herewith copy Meyer's illustrations as so far we have found no good specimens of the species.

**Teredo simplex** Lea, Pl. 59, Fig. 16

*T. simplex* Lea, Cont. to Geol., Dec. 1833, p. 38, pl. 1, fig. 6.

*Lea's original description.*—Shell thick, slightly curved, smooth exteriorly, tapering.

*Observations.*—Possessing but two or three fragments of the shell, it is impossible to make a perfect description. It differs from the *navalis* (Lam.) in the substance of the shell being thicker, and from the *tibialis* of Morton in being less thick, the cavity of the shell being very small. It has no transverse striæ like the *antenautæ* of Sowerby.

We have noted various, somewhat larger tubes of this Clairbornian bluff type, but none in which the true shell was preserved.

*Type.*—No. 5019* ,Lea Coll. Phila. Acad.

*Horizon.*—Claiborne Eocene.

**Teredo simplexopsis** de Gregorio, Pl. 59, Fig. 17

*Teredo simplexopsis* de Greg., Mon. Faun. Eoc. Ala., 1890, p. 236, pl. 38, figs. 26, a, b.

*Gregorio's original description.*—Testa tubulosa, cylindrica, potius tenuis, fere recta ; extremitate clausa, rotundata, non autem dilitata.

Au préalable, j'avais référé cette espèce à la *Teredo simplex* Lea ; mais en suite, ayant examiné quelque exemplaires de cette dernière espèce, je me suis apercu qu'ils appartenaient au genre *Serpula*. Notre espèce est beaucoup moins épaisse ; son intérieur est moins restrinct. La coquille garde encore un certain couleur rougeâtre.

Regarding this species Dall remarks (Trans. Wag., III, p. 813) that de Gregorio has identified what he (G.) regards as a *Serpula* tube from Claiborne, with Lea's species, and for the true *Teredo* tubes which occur in the Claiborne sands has proposed the name of *Teredo simplexopsis*, which probably may have to be regarded as a synonym of *Teredo simplex*, while the *Scrpula* will need a new name.

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*No. 5020 is a more irregular form of like dimensions.

**Astarte (Goodallia ?) americana** Dall, Pl. 32, Fig. 30

*Astarte* (*Goodallia*) *americana* Dall, Trans. Wag., III, 1903, p. 1496, pl. 56, fig. 5.

*Dall's original description.*—Shell small, compressed, nuculoid in form, anterior slope short, directly descending, posterior longer, arcuate; base arcuate, beaks low, lunule lanceolate, impressed, escutcheon obscure; surface finely concentrically striated; hinge of left valve with two diverging cardinals, inner margin smooth. Length 4.0, height 3.25, diameter 1.5 mm.

A single, somewhat worn left valve is all that we possess of this species. The form is very different from that of the Parisian species, but the hinge appears to be the same, the anterior tooth having been broken off and only its base remaining. The pallial line is certainly unsinuated, and taking all the circumstances into consideration it seems probable that this species should be referred to *Goodallia*, though it has somewhat the aspect of a Leptonaceous shell.

Eocene of the Claiborne sands, Claiborne, Ala.

Our Claiborne collections have furnished no additional specimens of this little species. Hence we have reproduced Dall's illustration and have quoted his description *verbatim*.

*The following names, in addition to those mentioned as synonyms in the foregoing text, may well be deleted from Eocene literature*

*Amara* (*Corbula*, *Tiza*) de Greg. Base on description of Conrad's *C. alta*, Vicksburgian. Mon. Faun., &c., p. 234.

*Bilineata* (*Cardita*) Tuomey, Geol. S. C., '48, p. 153, *nom. nud.*

*Camera* (*Ostrea*) Tuomey, Geol S. C., '48, [p. 154, *nom. nud.*

*Callosa* (*Astarte*) Con., Foss. Sh. Tert. &c., p. 39, indeterminable.

*Ebla* (var. *Ast. tellinoides*) de Greg., Mon., &c., p. 199; individual var.

*Estiva* (*Thracia*) de Greg., Mon Faun., &c., p. 230; unrecognizable cast, doubtfully Eocene.

*Gigantissima* (*Ostrea*) Finch, See Harris' Reprint of Conrad, p. [77].

*Ignus* (var. of *Glycymeris deltoideus*) de Greg., Mon. Faun., &c., p. 195 ; individual mutation.

*Læta* (*Ostrea*) de Greg., Mon. Faun., &c., p. 176 ; young *sellæformis*.

*McCordia* (*Cytherea*) Ruffin ; see Tuomey's Geol. S. C., '48, p. 154, *nom. nud.*

*Mittens* (var. *Curdium diversum*) de Greg., Mon. Faun. Eoc., &c., p. 215 ; Vicksburgian individual.

*Precuneata* (var. *Glycymeris deltoideus*) de Greg., Mon. Faun., &c., p. 194 ; indiv. var.

*Pitua* (*Astarte*) de Greg., Mon. Faun. Eoc., &c., p. 200 ; doubtfully Eocene.

*Politus* (*Lithodomus*) Tuomey, Geol. S. C., '48, p. 154 ; *nom. nud.*

*Postsulcata* (var. *Lucina impressa*) de Greg., Mon. Faun., &c., p. 203 ; indiv. var.

*proruta* (*Astarte*) Con., Foss. Shells, &c., p. 38 ; unrecognizable.

*Roperiana* (*Pholas*) Tuomey, Geol. S. C., '48, p. 155 ; *nom. uud.*

*Silicea* (*Perna*) Tuomey, Geol. S. C., p. 155 ; *nom. nud.*

*Subcuneata* (var. *Mact. parilia*) de Greg., Mon. Faun. Eoc., p. 228 ; indiv. var.

*Sublævigata* (var. *Lucina parilis*) de Greg., Mon. Faun., Eoc., p. 203 ; indiv. var.

*Striatus* (var. *Glycymeris deltoideus*) de Greg., Mon. Faun. Eoc., &c., p, 194 ; indiv. var.

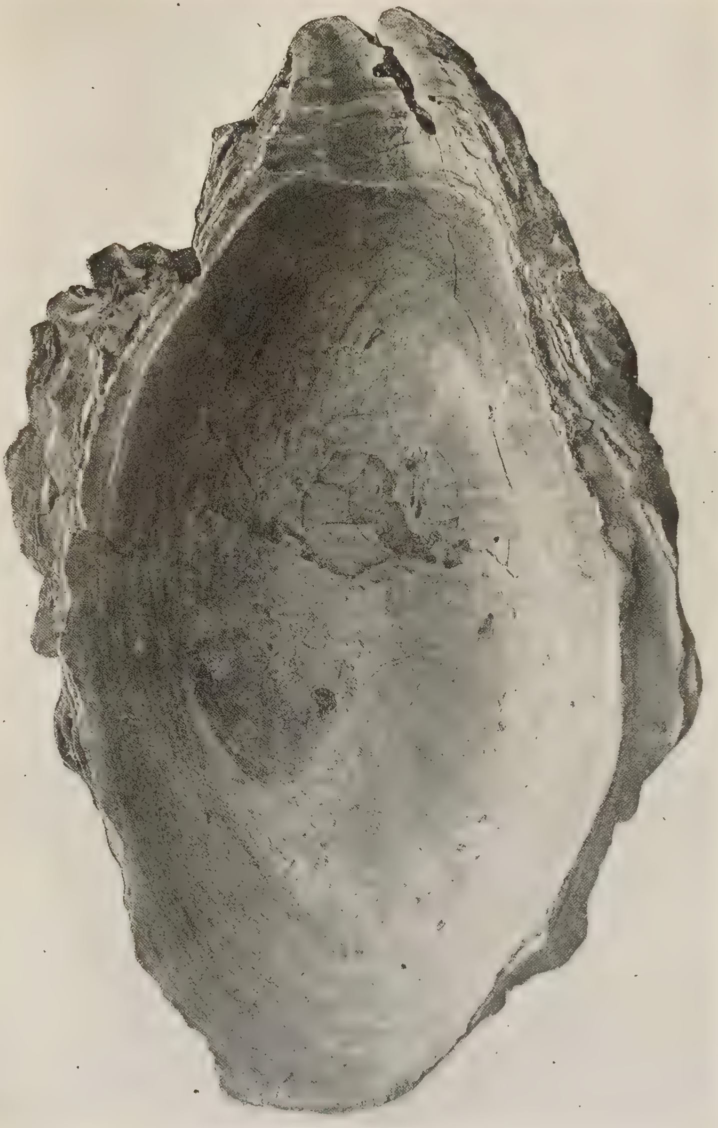
*Symetrica* (var. *Gratelupia hydana*) de Greg., Mon. Faun., &c., p. 221 ; young specimen.

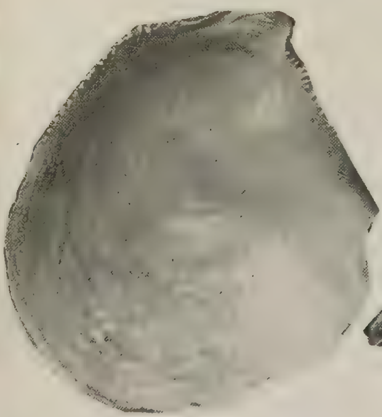
# EXPLANATION OF PLATES

*Note.—Unless some statement is made to the contrary, it may be assumed that the specimens from which these illustrations were made are now deposited in the Paleontological Laboratory at Cornell University.*

## PLATE I

| Figure | Page |
|---|---|
| *Ostrea alabamiensis* Lea. | 8 |
| Adult from Claiborne, Ala. ; × ⅞. This is the form labelled by Conrad, "*O. claibornensis* Con.", in the Philadelphia Academy Collection. | |





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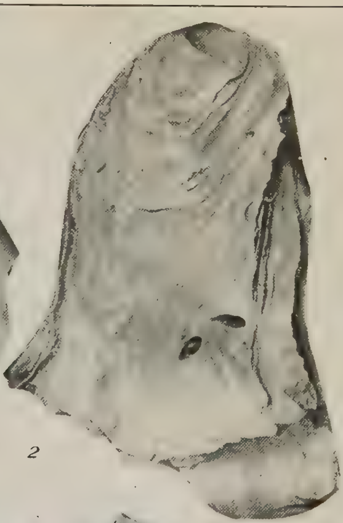

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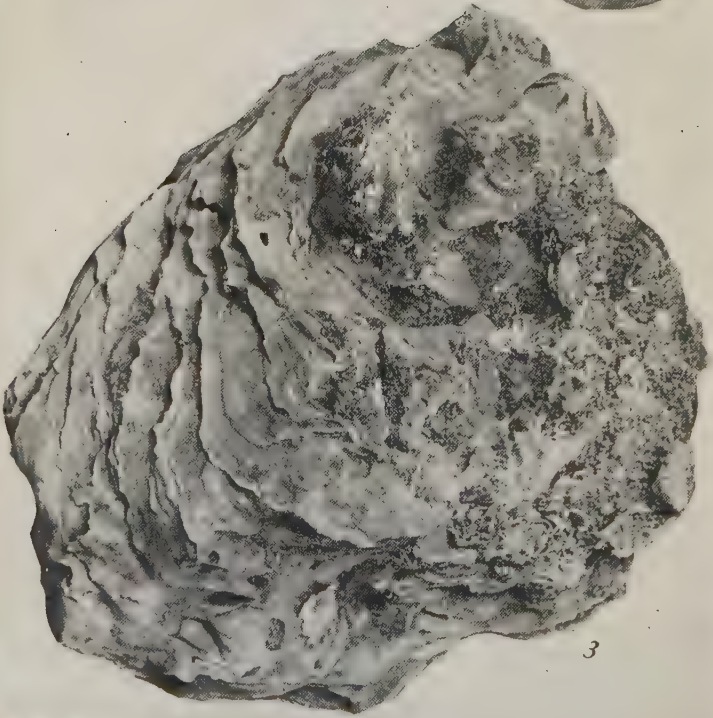

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## PLATE 2

Figure Page

1-3. *Ostrea alabamiensis* Lea, Claiborne...................................... 9

Fig. 1, × 1. Young, thin specimen.

2, × 1, showing some contraction with lamellate and divaricate sculpture.

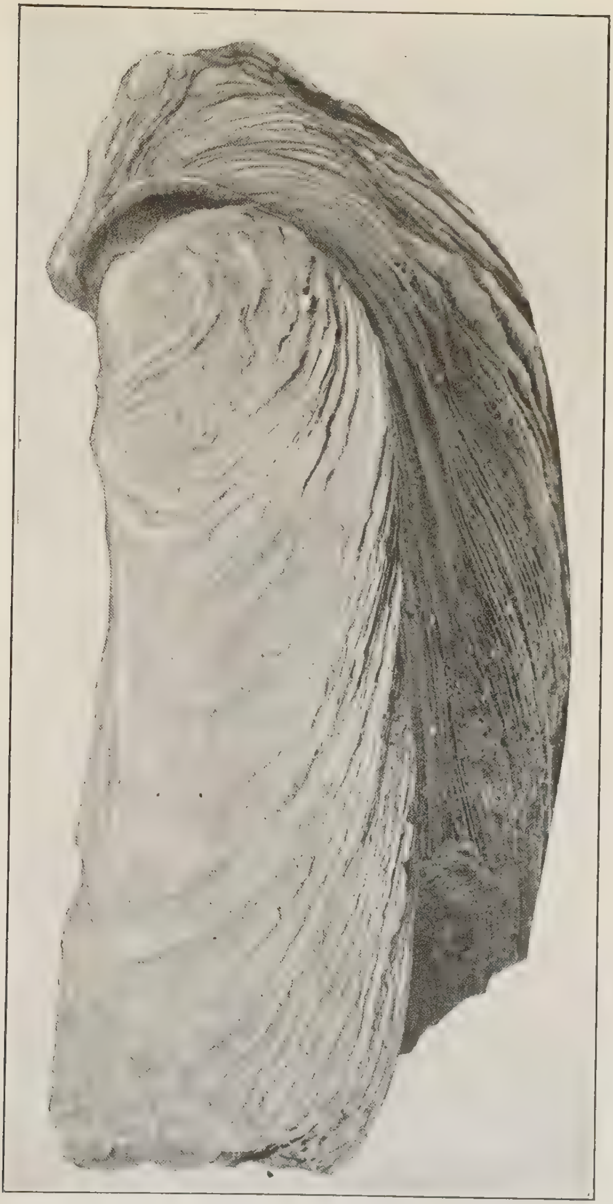
3, usual adult form, showing distortion and diseased condition.

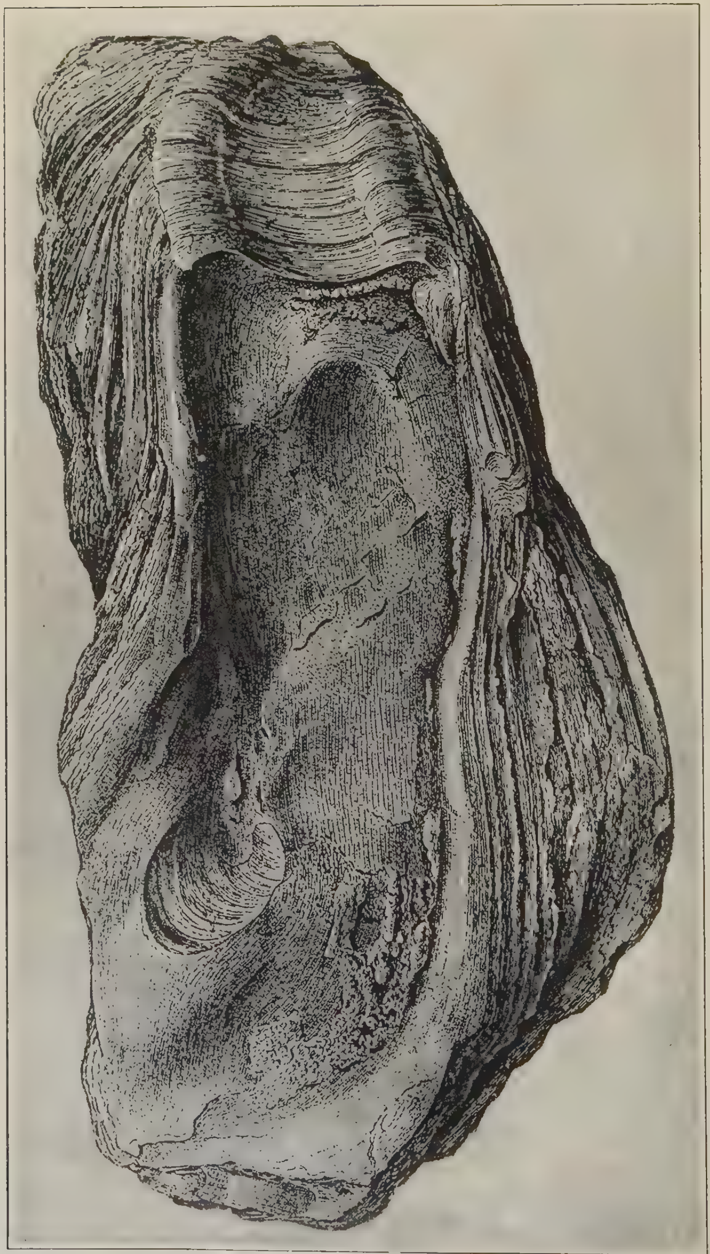
## PLATE 3

Figure | Page

*Ostrea alabamiensis* (var. *contracta*) Con........................................... 9

Showing young, *Anomia*-like stage of *alabamiensis*, divaricate epidermis, with lamellation somewhat as in *frionis* ; general form and size of *geogiana*, contracted beak of *contracta* ; × 2-3, Shell Bluff, Ga. Jackson Eocene.





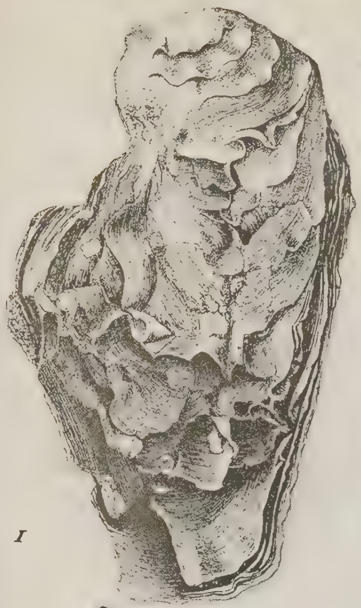
## PLATE 4

| Figure | Page |
|---|---|
| *Ostrea* var. *contracta* Con., × ¾ ........................................................ | 9 |

From "above Roma, Starr Co., on the Rio Grande, Tex." Texas State Mus. Coll. Probably Jacksonian age.

## PLATE 5

| Figure | | Page |
|---|---|---|
| 1. | *Ostrea alabamiensis* var. *frionis* Har., × ¾ ........................... San Miguel Cr., S. E. corner of Frio Co., Tex., below De Viller's ranch. Texas State Museum, No. 1710. | 9 |
| 2. | *O. alabamiensis* Lea × ½ ; form called *georgiana*, Shell Bluff, Ga., C. U. Mus. No. 34,048. While young showing characteristics of *alabamiensis* with *frionis*-like plications, and when adult having typical *contracta*-like umbones ; size of *georgiana*. Jackson Eocene. | |
| 3. | *O. alabamiensis* var. × 1 ; young and thin with traces of plications ; Burleson Shell Bluff of Penrose's report, Brazos River ; one mile below Milam-Burleson Co. line. Texas State Museum, No. 55 | |



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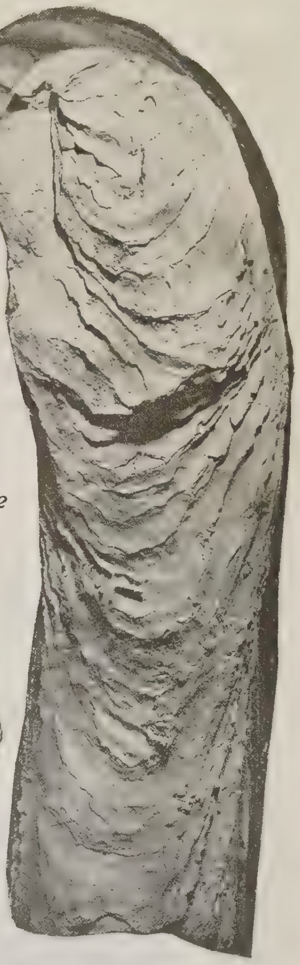

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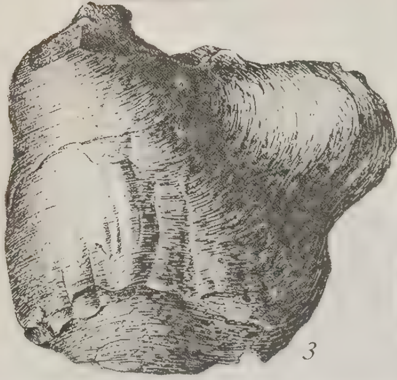

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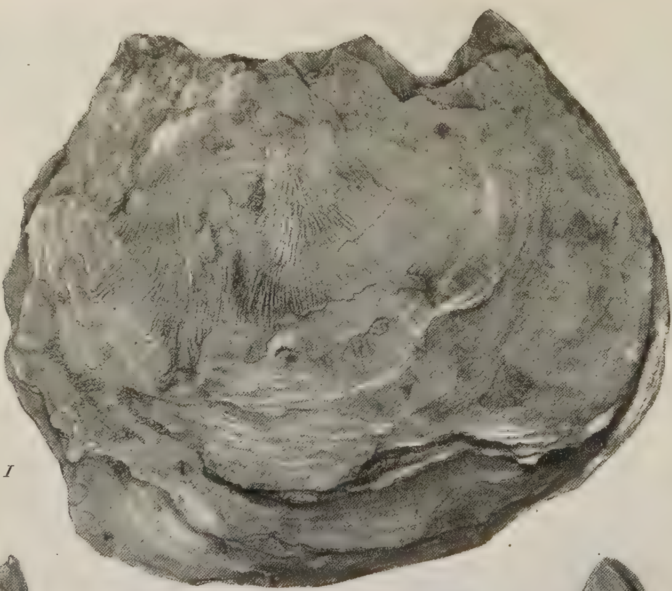
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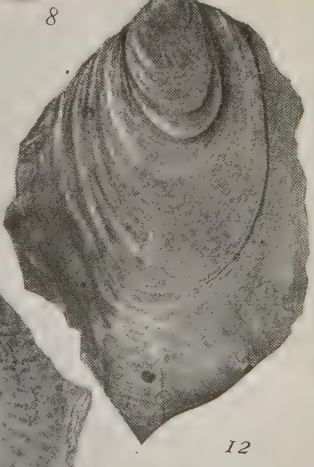
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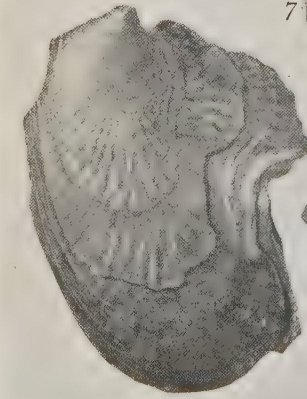
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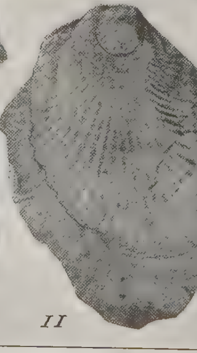
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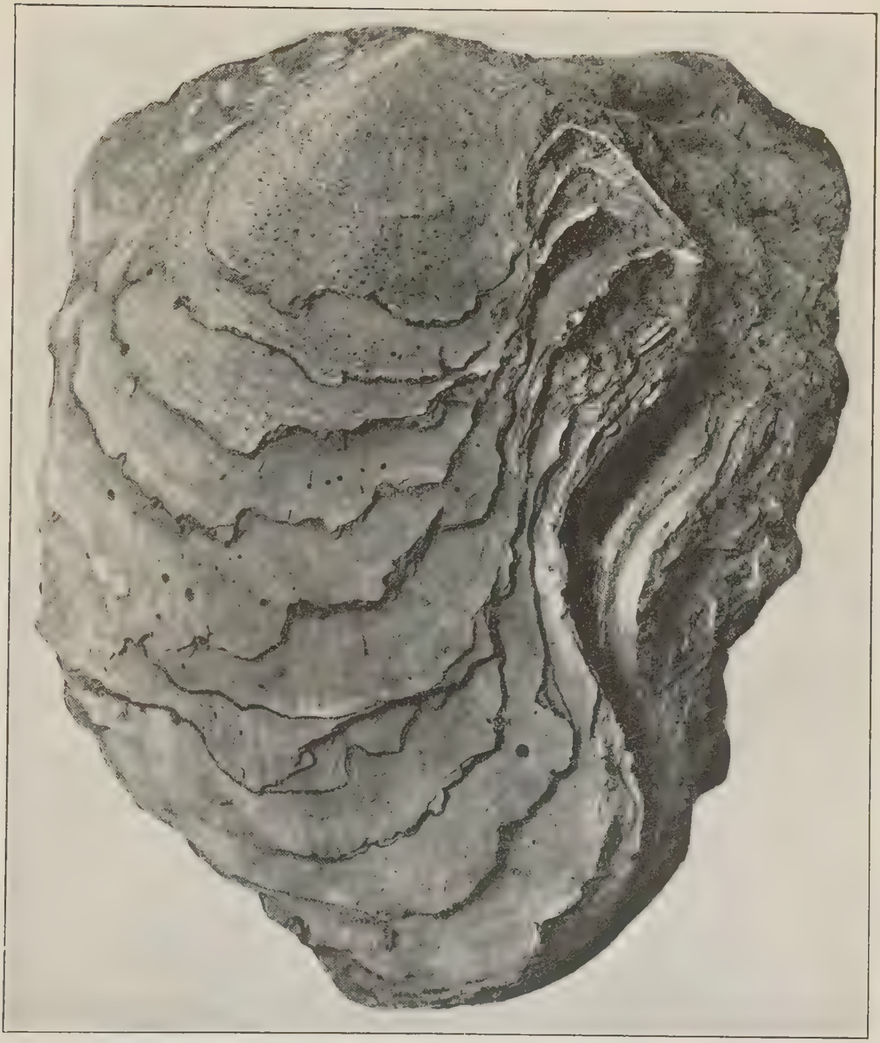
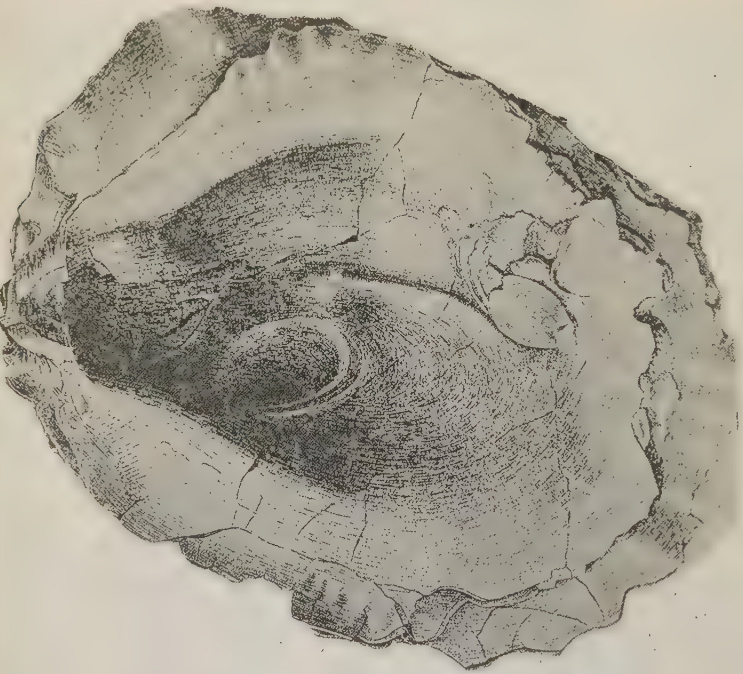
## PLATE 6

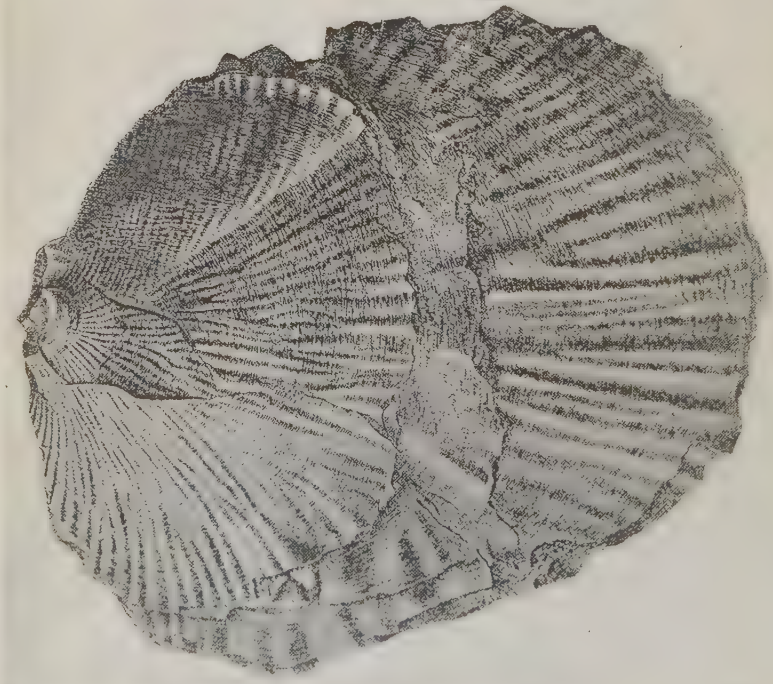
| Figure | | Page |
|---|---|---|
| 1. | *Ostrea alabamiensis* Lea × 1<br>Young, showing radii and beginnings of plications. Claiborne, Ala. | 9 |
| 2-12. | *O. sellæformis* Conrad, × 1<br>Young, showing both valves and various stages of posterior flexure. Base of bluff at Claiborne, St. Maurice stage. | |
| 5. | Represents a young specimen with concentric growth-lines well developed in comparison with the strength of the radii, var. *læta* de Greg., p. 201. | |

## PLATE 7

| Figure | Page |
|---|---|
| *Ostrea sellæformis* Con., × ¾<br>Adult from the base of Claiborne Bluff; St. Maurice stage. | 11 |





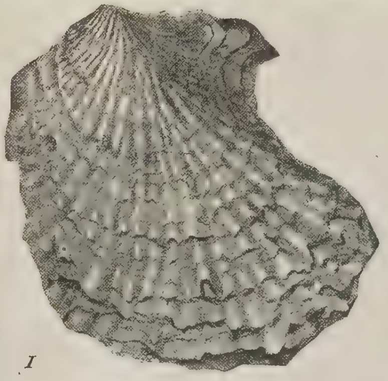


## PLATE 8

| Figure | Page |
|---|---|
| *Ostrea sellæformis* var. *smithvillensis* Har., × ¾ ................................ <br>From Smithville, Tex. | 11 |

## PLATE 9

| Figure | | Page |
|---|---|---|
| 1-6. | *Ostrea sellæformis* var. *lisbonensis* Harris<br>About natural size ; showing thick, heavy shell and Aviculoid form ; Chestnut, La. St. Maurice stage. | 12 |
| 7. | *O. sellæformis* var. *divaricata* Lea<br>From Newton, Miss. | 12 |
| 8. | *O. sellæformis* var. *vermilla* de Greg<br>Bienville Parish, La. | 12 |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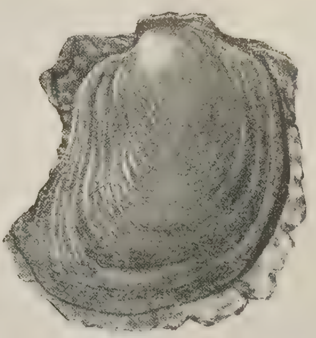
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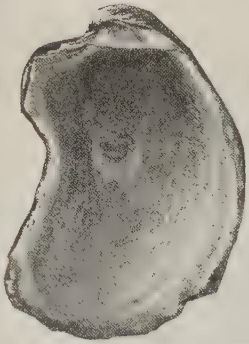
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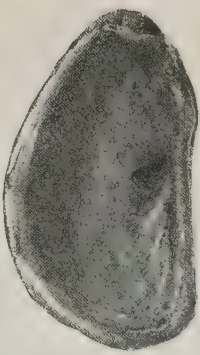
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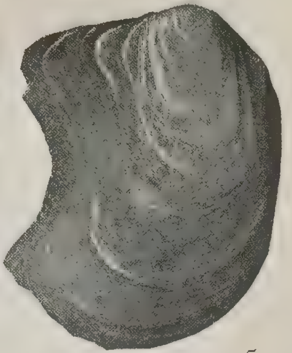
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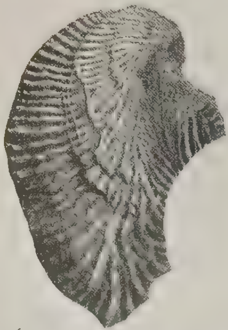
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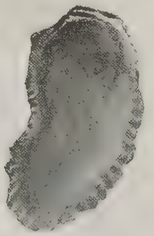
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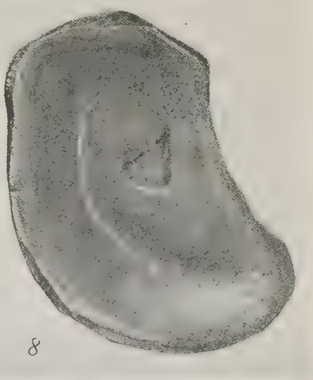
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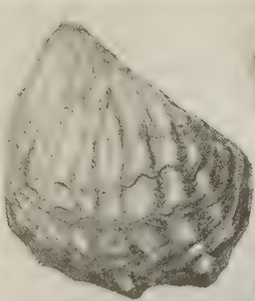
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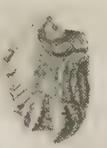
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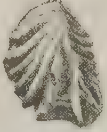
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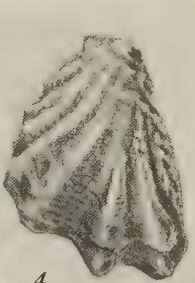
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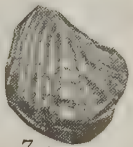
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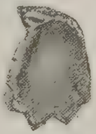
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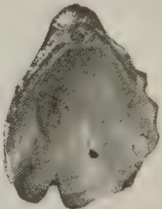
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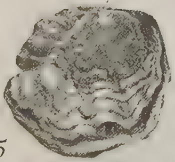
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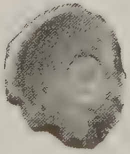
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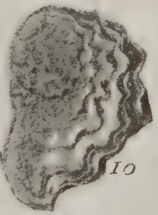
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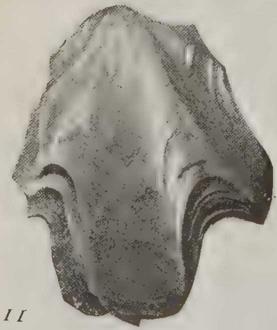
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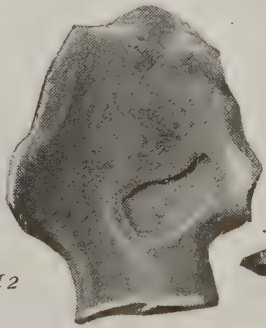
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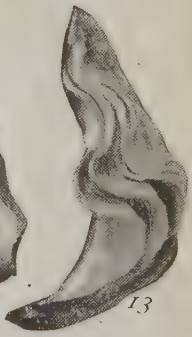
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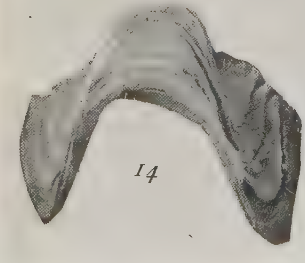
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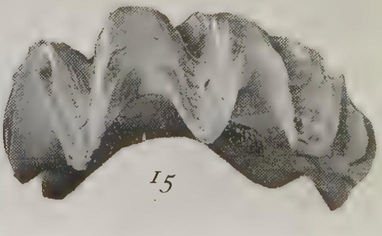
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## PLATE 10

| Figure | | Page |
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| 1-10. | *Ostrea vicksburgensis* var. *ludoviciana*, n. var.. ..................... <br> About natural size; showing form and markings of both valves. Figs. 2 and 6 from Natchitoches, others from Chestnut, La. | 14 |
| 11-15. | *Ostrea johnsoni* Aldrich....................................................... <br> About natural size. 11-13, Caton's Bluff, Ala. 15, Lisbon, Ala. | 15 |

## PLATE II

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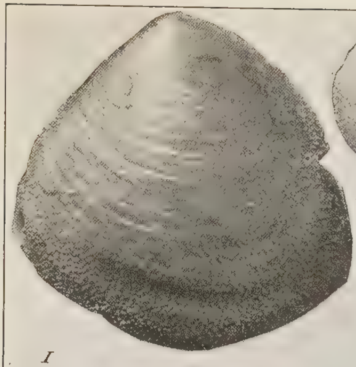
1-3. *Anomia ephippioides* Gabb, × 2........................................ 16
Figs. 1-2, from Sabine River ; 3 from East Texas. Harris Coll.

4, 5. *Anomia navicelloides* Ald. var. *hammetti* Har......................... 18
Fig. 4 is 19 x 15 mm., 5 is 14 x 13 mm. From Hammett's Branch, La. See also pl. 12, figs. 1 and 2.

6-8. *Anomia lisbonensis* Ald. × 1 ............................................. 17
Fig. 6 from Lisbon, 7 and 8 from base of Claiborne Bluff, Ala. ; 9 and 10, from Louisiana. 9 and 10 × 3.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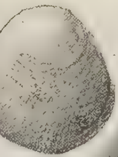
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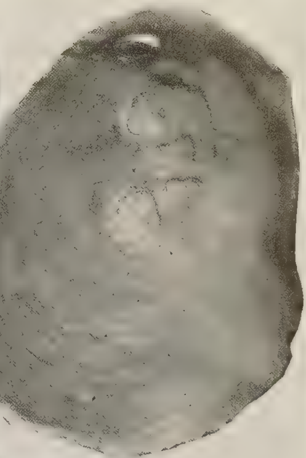
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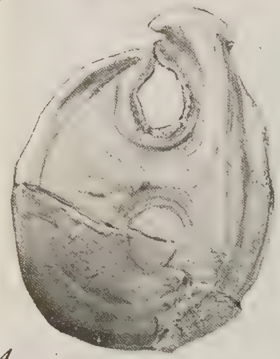
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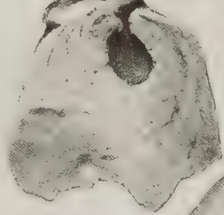
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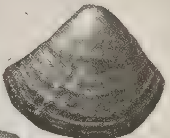
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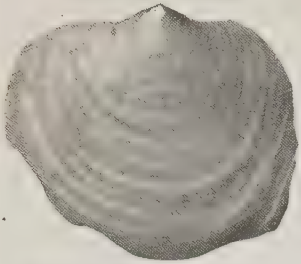
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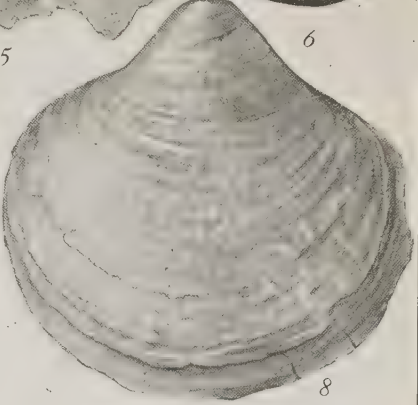
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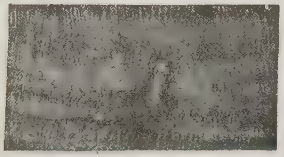
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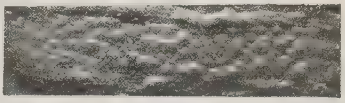
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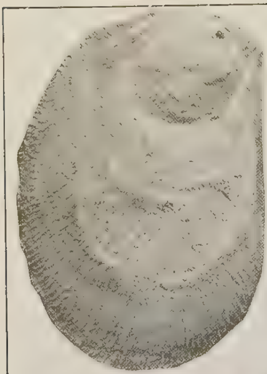

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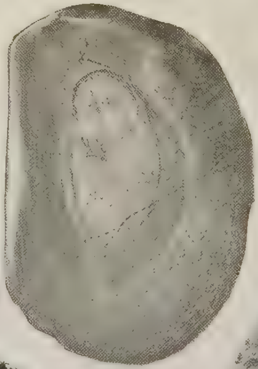

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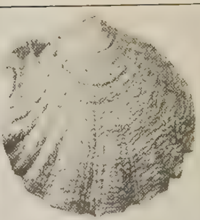

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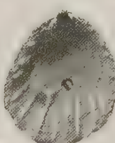

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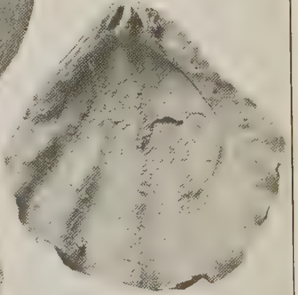

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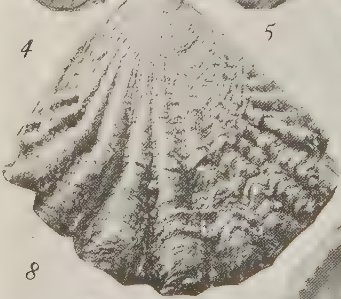

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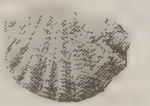

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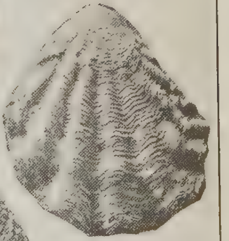

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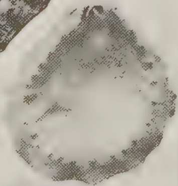

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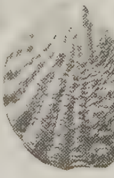

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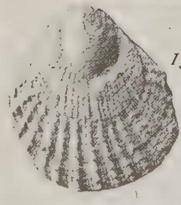

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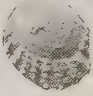

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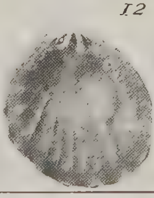

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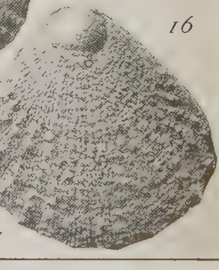

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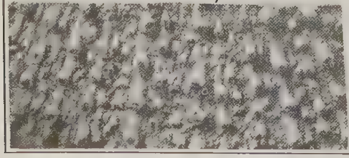

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## PLATE 12

| Figure | | Page |
|---|---|---|
| 1, 2. | *Anomia navicelloides* var. *hammetti* Har., 20 x 14 mm............<br>Exterior and interior of upper valve ; Hammett's Branch, La. | 18 |
| 3-8. | *Plicatula filamentosa* Con., × 2..........................................<br>Claiborne sands, Claiborne, Ala. | 18 |
| 9-12. | *P. fil.* var. *concentrica* Dall, × .2... .......................................<br>Columbus, Tex. | 19 |
| 13-16- | *P. fil.* var. *planata* Ald., × 2..............................................<br>Wautubbee, Miss. | 19 |
| 17. | The same, enlarged about 4 times ; Hickory Miss. | |

## PLATE 13

Figure Page

1. *Pecten deshayesi* Lea, var., × 2........................................ 19
This seems to be a variety of *deshayesi*, but larger, more circular in outline, slightly less ventricose in the umbonal region, with a greater umbonal angle and more orderly costation than the usual *deshayesi*. The specimen is stained reddish and doubtless came from the *Scutella* layer just above the "sand".

2. *Pecten deshayesi*, × ⅓........................................................ 20
Left valve of the *lyelli* type, rare.

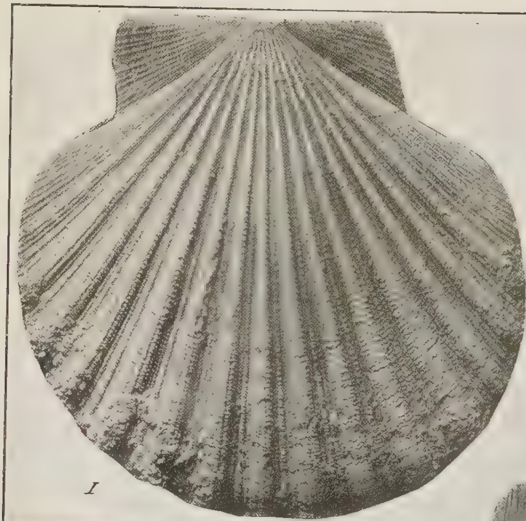
3, 7. The most common type of *Pecten* at Claiborne ; heights 17 and 25 mm. ; the one to which Lea gave the name of *lyelli*.

4, 5. *Pecten deshayesi* Lea ; × 2 ; portions of left valves.

6. *Pecten deshayesi* Lea ; × 1.6. Much like the type specimen though showing imbricate sculpture much more definitely, but with less pronounced intercostal ribbing.

8. *Pecten* sp., × 1.5, "worn" valve of *deshayesi* as interpreted by authors. Its orbicular form, lack of agreement in most all respects with the ordinary right valves of this species, generally called *lyelli* would seem to place such forms in another species. Possibly these smooth-ribbed forms had better be referred to a variety of our *cawcawensis*.

All the above are from Claiborne, Ala.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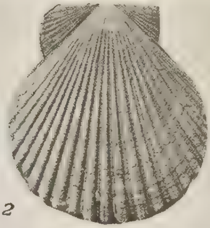
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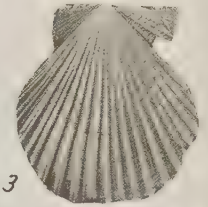
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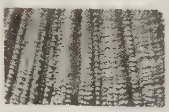
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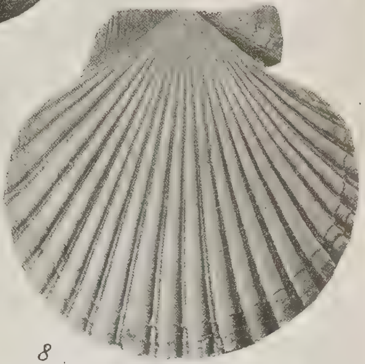
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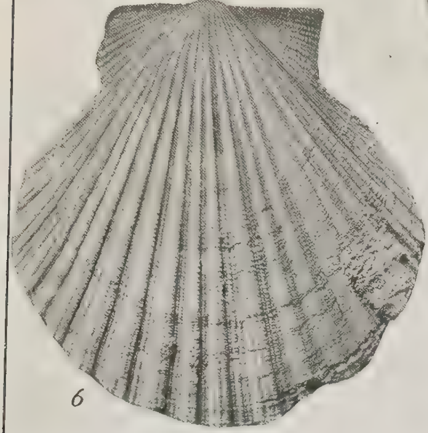
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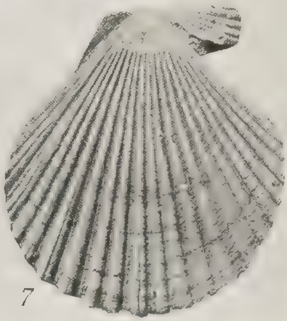
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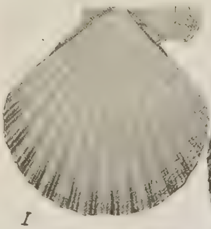
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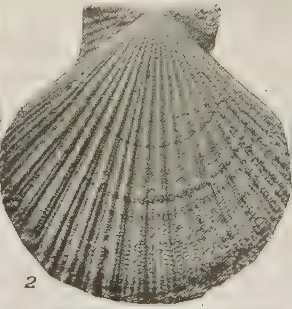
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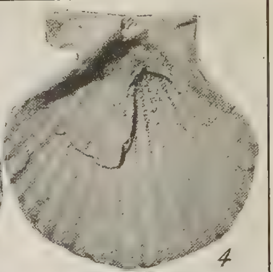
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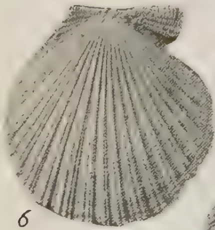
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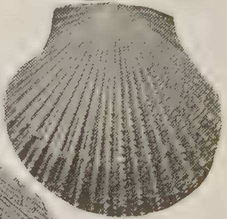
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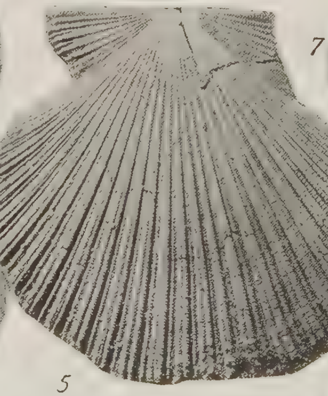
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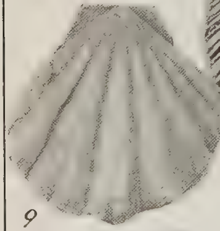
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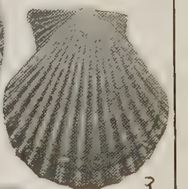
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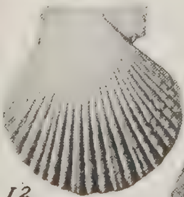
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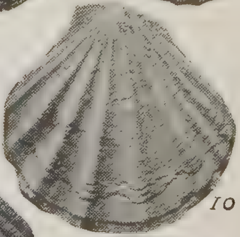
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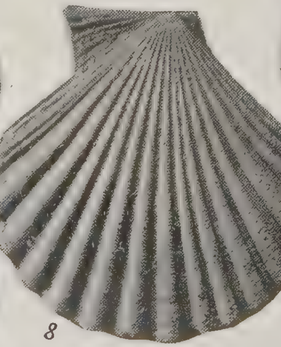
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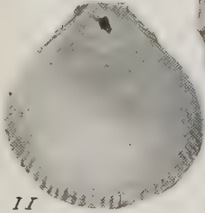
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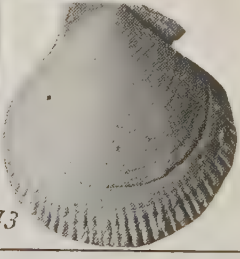
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## PLATE 14

Figure | Page

1. *Pecten wautubbeanus* Dall, × 2 .......................................... 21
Right valve, common form, showing tripartite subdivision of ribbing near the basal margin ; lack of strong ribbing over much of the surface of the valve. Wautubbee, Miss.

2. The same, × 2 ; showing well defined but unornamented ribbing in umbonal region. Hickory, Miss.

3. The same, × 2, left valve. Notice the simple ribbing till the peripheral region is reached ; also the well marked ornamentation of ribs throughout. Hickory, Miss.

4. The same, right valve ; × 1.5 ; interior.

5. Variety of *wautubbianus*, × 1.6 .......................................... 23
Large, very thin, with dual subdivision of costæ. From the basal beds, Claiborne Bluff.

6, 7. Variety *willcoxi* Dall, × 3.................................................. 23
From specimens furnished by the U. S. Nat. Mus., from "Eocene, Clark Co., Ala."

8. Variety *cainei* Harris, × 2.2.............................................. 24
Right valve, from Wautubbee, Miss.

9. *Pecten pulchricosta* Mr. and Ald., × 2.................................. 24
Showing characteristics mentioned by the describers. Wautubbee, Miss.

10. The same, × 2.5, left valve, showing characteristictics mentioned by Dall (Tr. Wag., p. 730). Wautubbee, Miss.

11. *Pecten* (*clarkeanus?* var.) *burlesonensis*, n. var., × 2............... 26
From a specimen furnished by the U. S. Nat. Mus., from "Black Bluff Shoals", Brazos River, Texas.

12. The same, × 1½. From "Burleson Bluff", Brazos River, Tex.

13. The same, × 1½. From "Collier's Ferry", Brazos River, Texas State Museum specimen.

## PLATE 15

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| 1. | *Pecten cawcawensis*, n. sp., × 1.5<br>From a gutta-percha squeeze of the umbonal region of a right valve. | 27 |
| 2. | The same, surface markings more distinctly shown. | |
| 3. | The same, × 1.5, right valve showing some of the exterior. | |
| 4. | The same, ×1.5, portion of the surface of a right valve showing surface in fair state of preservation. | |
| 5. | The same, × 1.5. interior impression of left valve. | |
| 6. | The same, × 1.5, fragment showing exterior characteristics of large left valve. | |
| 7. | The same, × 1.1, showing exterior of left valve about the periphery. All the above are from near Cawcaw Swamp; S. C. | |
| 8. | *Pecten clarkeanus* Ald., × 1.5 | 25 |
| 9. | The same, specimens loaned by Aldrich from the type locality, Sowilpa Cr., Ala. | |
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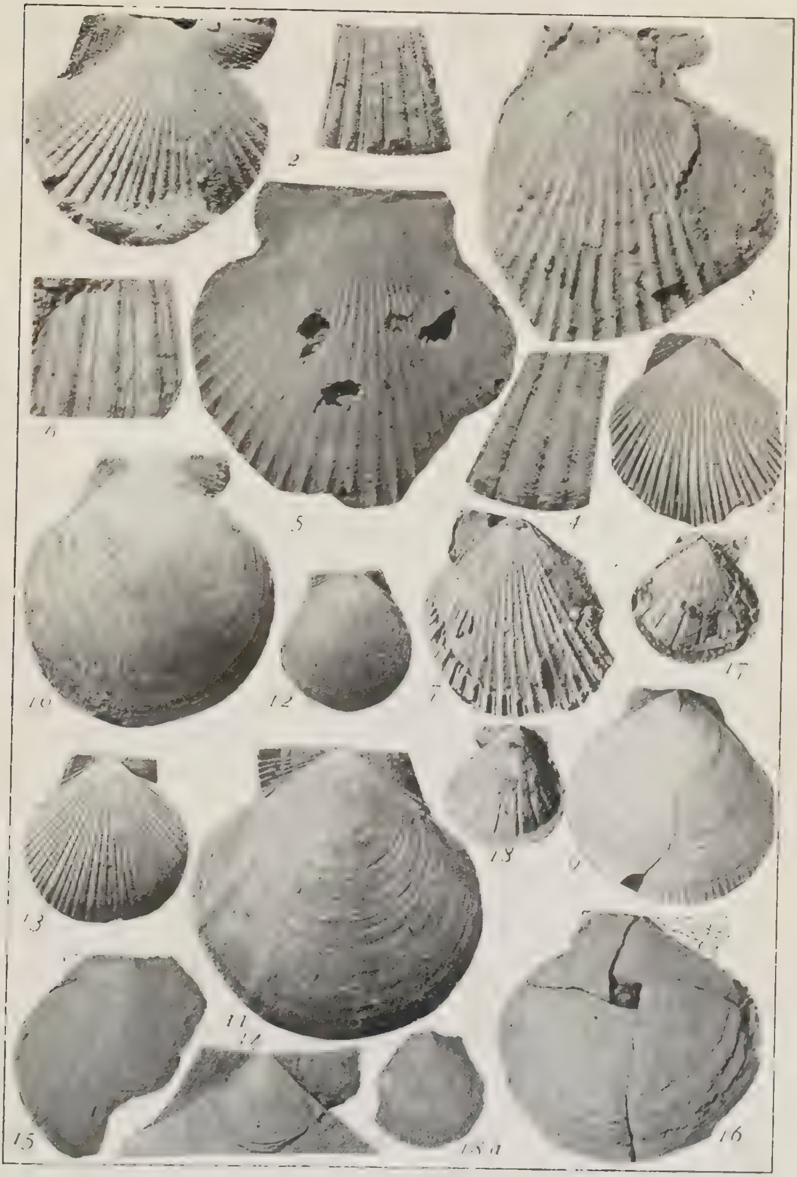
| 14. | *Pecten scintillatus* Con., ×2.8<br>From the Jackson beds of Miss. Here inserted for comparison with the following : | 28 |
| 15. | *Pecten scintillatus* var. *corneoides*, n. var., × 1<br>Left valve. | 28 |
| 16. | The same right valve. Both valves from St. Maurice, La. | |
| 17. | *Amussium squamulum* Lam. ?, × 4 | 28 |
| 18. | The same, × 4, cast of hinge area, opposite, or right valve. From Negreet Bayou. | |
| 18 a. | The same, × 6, showing well preserved exterior markings. | |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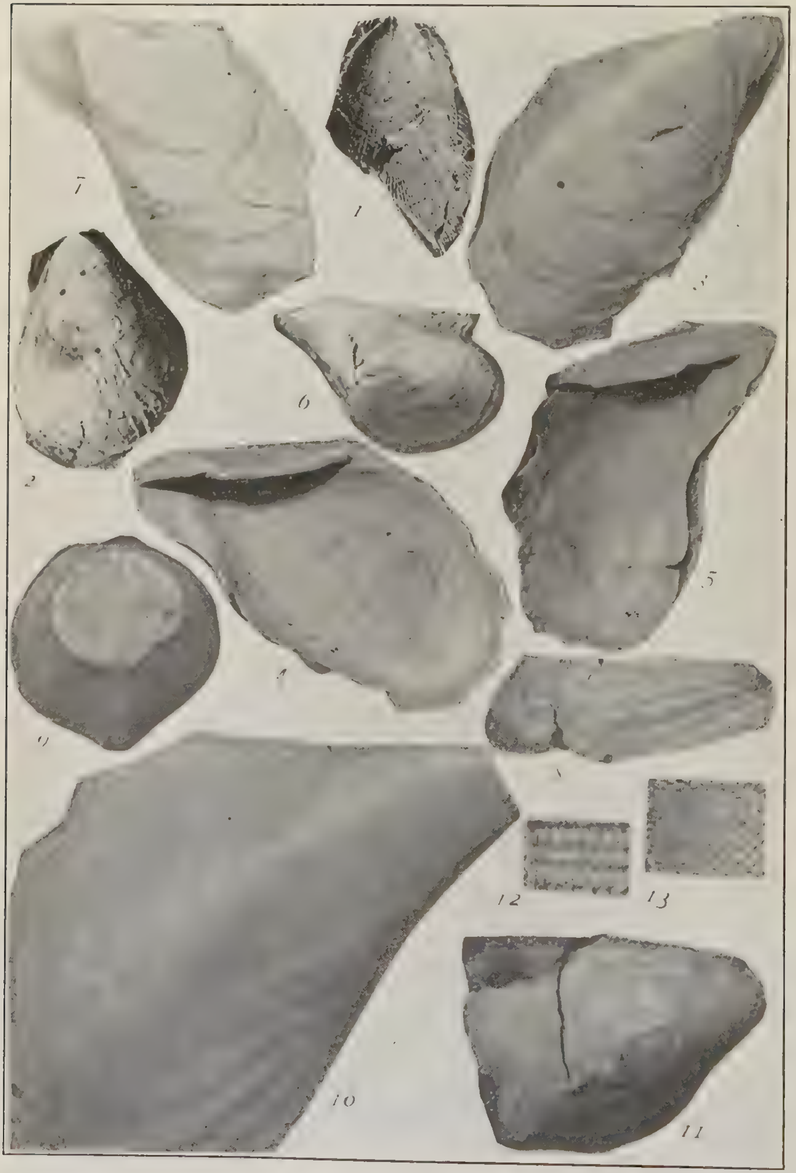
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## PLATE 16

| Figure | | Page |
|---|---|---|
| 1-2. | *Lima harrisiana* Ald., × 1¼ ; Winn Parish, La. | 29 |
| 2-3. | *Pteria limula* Conrad, natural size<br>Showing hinge, thickening of shell in adult, muscular scars and general outline of the valves. All from the Claiborne "sand". | 29 |
| 8-11. | *Pinna gravida*, n. sp., natural size<br>Showing outline, cross-section and surface markings so far as known. From St. Maurice, La. | 30 |
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## PLATE 17

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| 17-20. | *Crenella margaritacea* Con., × 4 | 35 |
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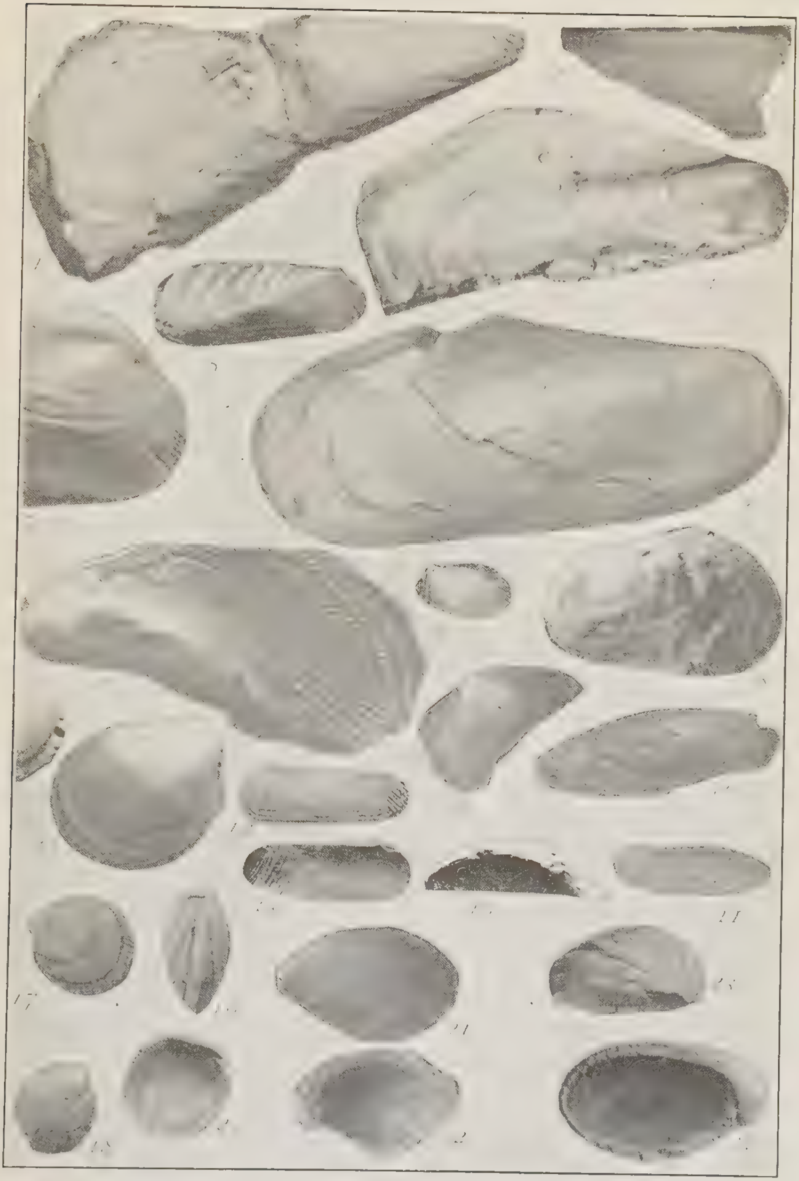

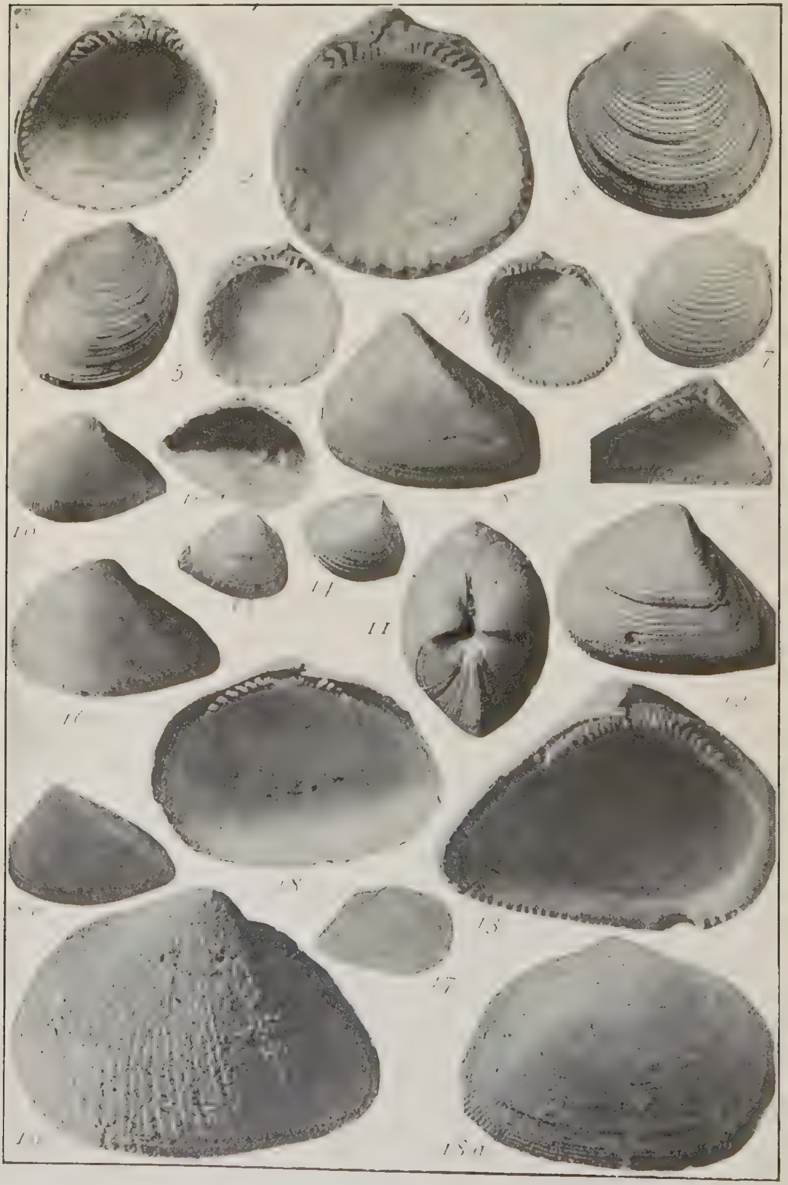
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## PLATE 18

| Figure | | Page |
|---|---|---|
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| | 2, 11 mm., Hickory, Miss. | |
| | 3, 8 mm., St. Maurice. | |
| | 4, 7.5 mm., St. Maurice. | |
| | 5, 5.5 mm., St. Maurice. | |
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| | Fig. 11, 13 mm., Smithville. | |
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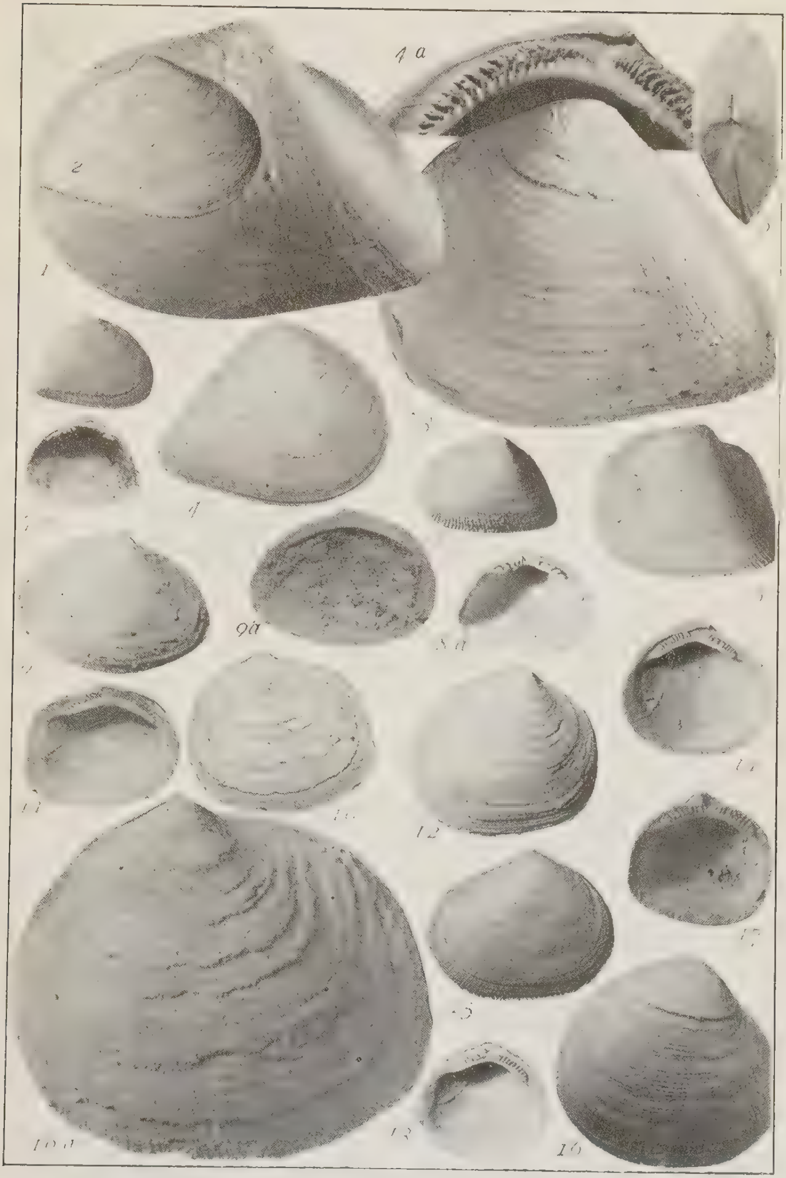
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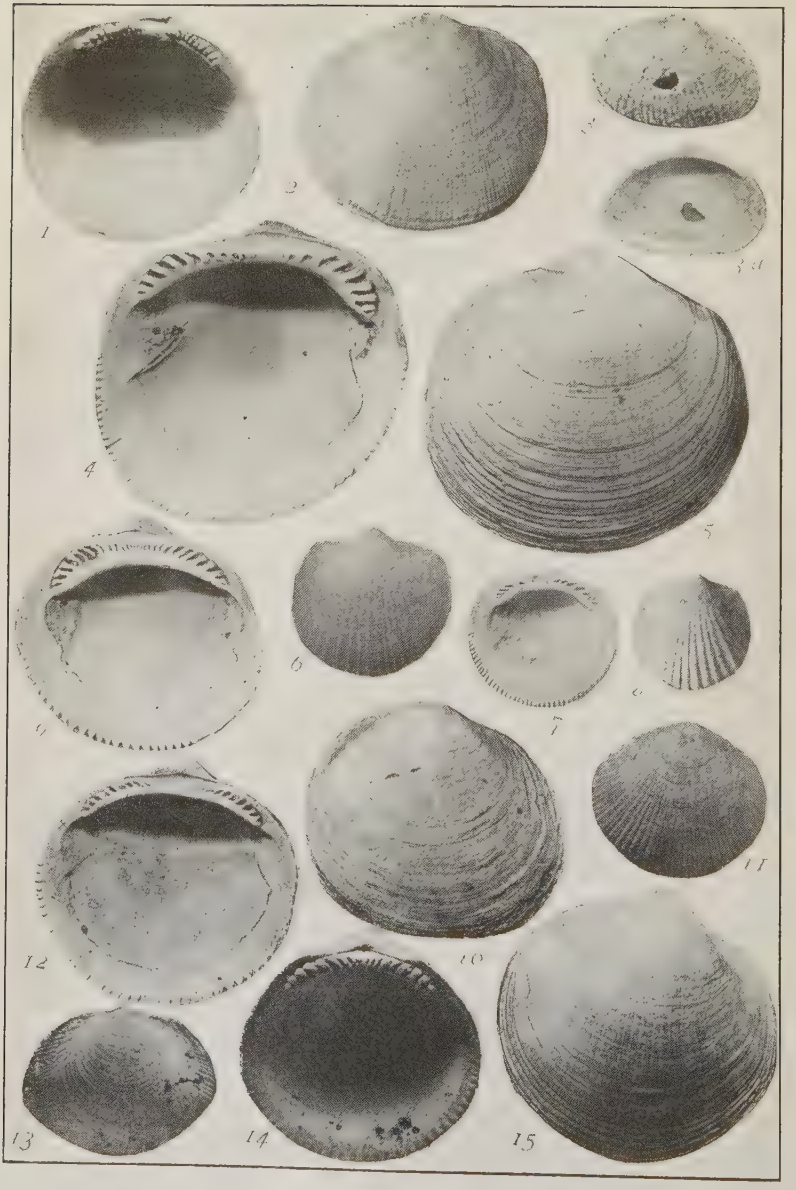
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| 1, 2. | *Trinacria cossmanni* Dall | 45 |
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| | 7, 14 mm. | |
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| | 11, 6 mm. | |
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| | Fig. 12, 36 mm. | |
| | 13, apical view of a young specimen, 6.7 mm, | |
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PLATE 21

Figure Page

1-7. *Glycymeris trigonella* Con........................................ 49

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2, 10 mm., Claiborne sand.
3, var. *minor*, 14 mm., Claiborne sand.
4, (young), 5 mm., Claiborne sand.
5, a, var. *wautubbeana*, 8 mm., Mississippi var.
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8-10. *Glycymeris sabinensis*, n. sp........................ ...................... 51

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9, 8 "
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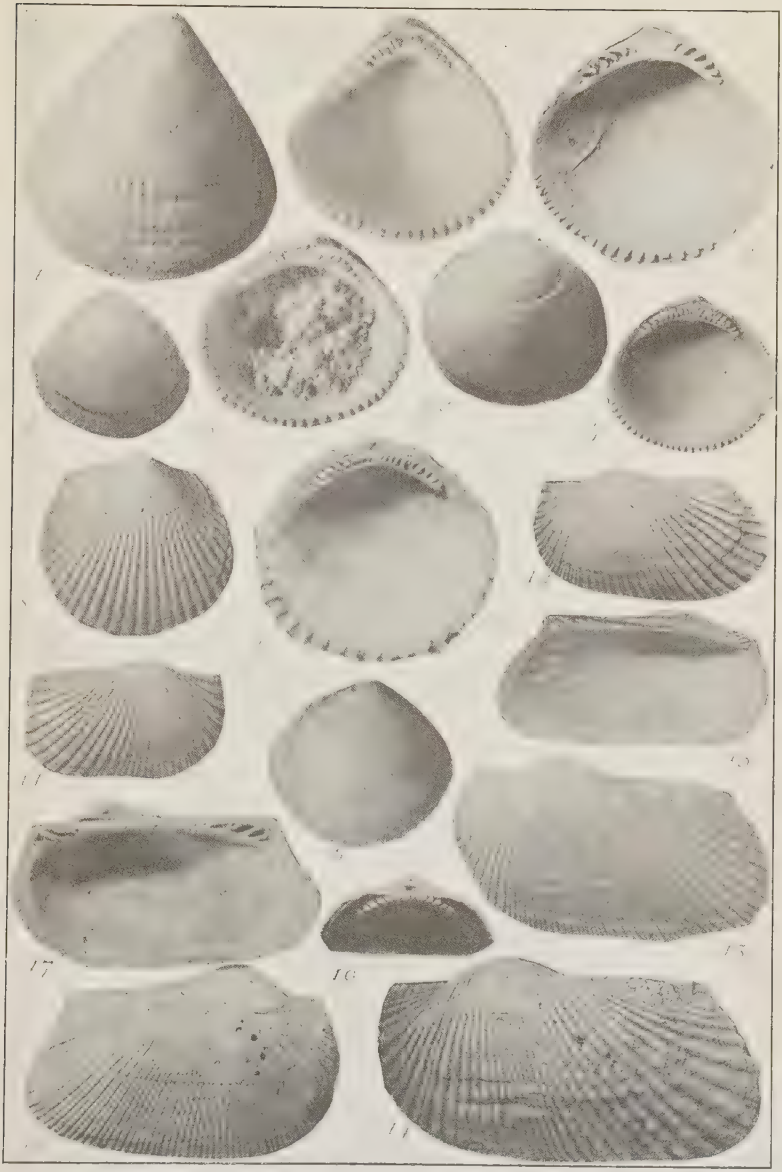
12, 22 "
13, (inside view of fig. 1, pl. 22.)
14, Orangeburg, S. C., specimen. 30 mm.
15-17, var. *subscopula*, n. var., Lisbon specimens.
15, 30 "
16, 17, 28.5 mm.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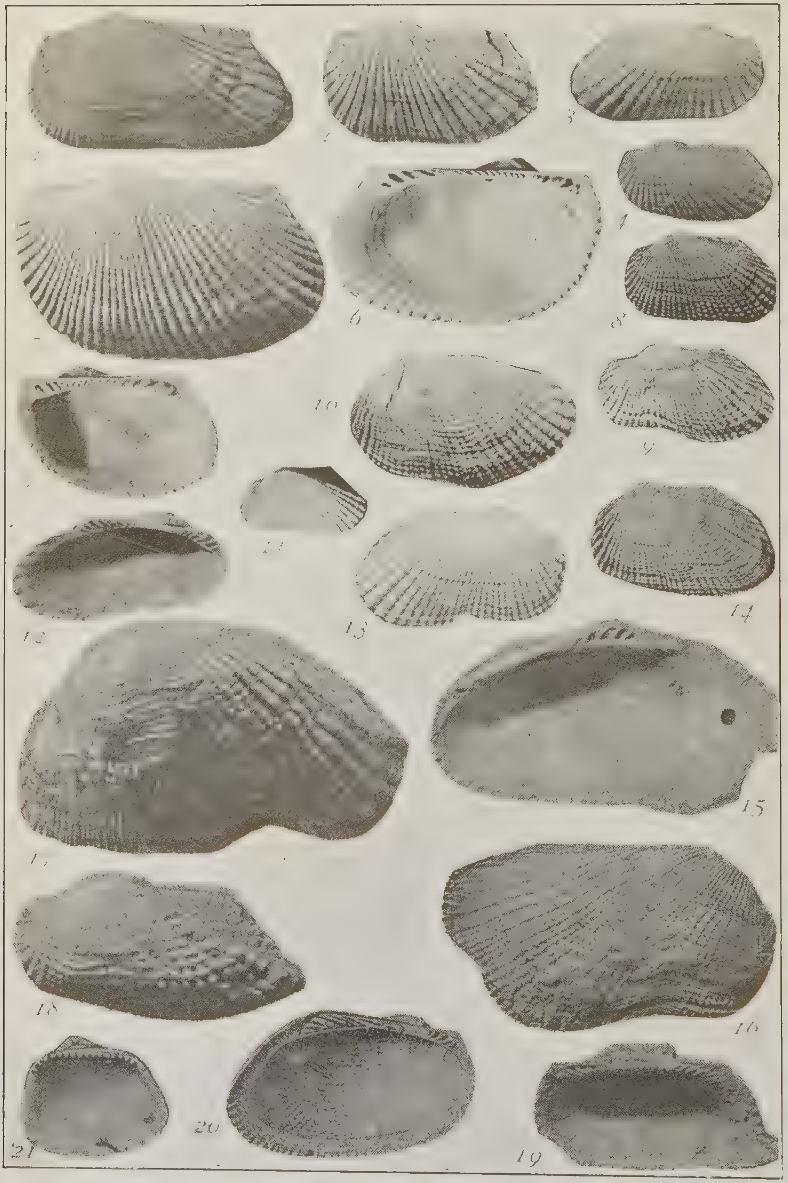
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## PLATE 22

Figure Page

1. *Arca rhomboidella* Lea, 36 mm.......... .................................. 51
An adult Claiborne sand specimen, figured somewhat less than natural size but showing characteristic markings. For interior, see pl. 21, fig. 13.

2-4. *Arca rhom.*, var. *parsaba*, n. var.......................................... 52
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3, 6.5 mm.
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6, 13 "
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8-16. *Byssoarca* (*cuculloides ?*), var. *ludoviciana*, n. var.................. 54
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9, 13 "
10, 16 "
11, 6 "
12, 15 "
13, 7 "
14, 13 "
15, 31 "
16, 32 " from the Sabine River, La Tex.

17. *Byssoarca cuculloides* Con., 55 mm......................................... 54
Type, Phila. Academy Coll. Jacksonian.

18. *Arca reticulata* Gmel., 14 mm............................................. 55
From Newton, Miss.

19. The same; 10 mm.

20. *Arca aldrichi* Dall, 8 mm.................................................. 55
Claiborne.

21. *Arca harrisi* Sheldon, 5 mm............................................... 56
Specimen probably in Coll. Johns Hopk. Univ.

PLATE 23

Figure Page

1-4. *Leda semen* Lea .......... 57
Fig. 1, 8.5 mm., Lisbon.
2, 7 mm., Claiborne sand.
3, 8 mm., Claiborne sand.
4, 6 mm., 6 mi. W. N. W. of Orangeburg, S. C.

5-6. *Leda seminoides* Aldrich .......... 57
Fig. 5, 15 mm., Lisbon.
6, 17 " Lisbon.

7-9. *Leda cœlata* Conrad .......... 57
Fig. 7, 12 mm., Claiborne.
8, 22 " Claiborne.
9, 25 " Claiborne.

10. *Leda cœlatoides*, n. sp., 13 mm .......... 58
Wautubbee, Miss.

11-12. *Leda multilineata* Conrad .......... 58
Fig. 11, 11 mm., Wautubbee.
12, 12 mm., Wautubbee.

13. *Leda houstonia* Harris, 6 mm .......... 59
Trinity River, Tex. ; Tex. State Mus.

14-17. *Leda plana* Lea .......... 60
Fig. 14, 32 mm., 17 mi. above Newbern, N. C.
15, × 6 ; Claiborne.
16, 5 mm., Baker's Bluff, Ala. Aldrich Coll.
17, 4.2 mm., Baker's Bluff, Ala. Aldrich Coll.
Figs. 16 and 17 are the so-called *pulcherrima* of Lea's *Contributions*.

18-19. *Leda trumani*, n. sp .......... 61
Specimen 32 + in length ; from the St. Maurice clays at the base of Claiborne bluff.

20.23. *Leda opulenta* Conrad .......... 62
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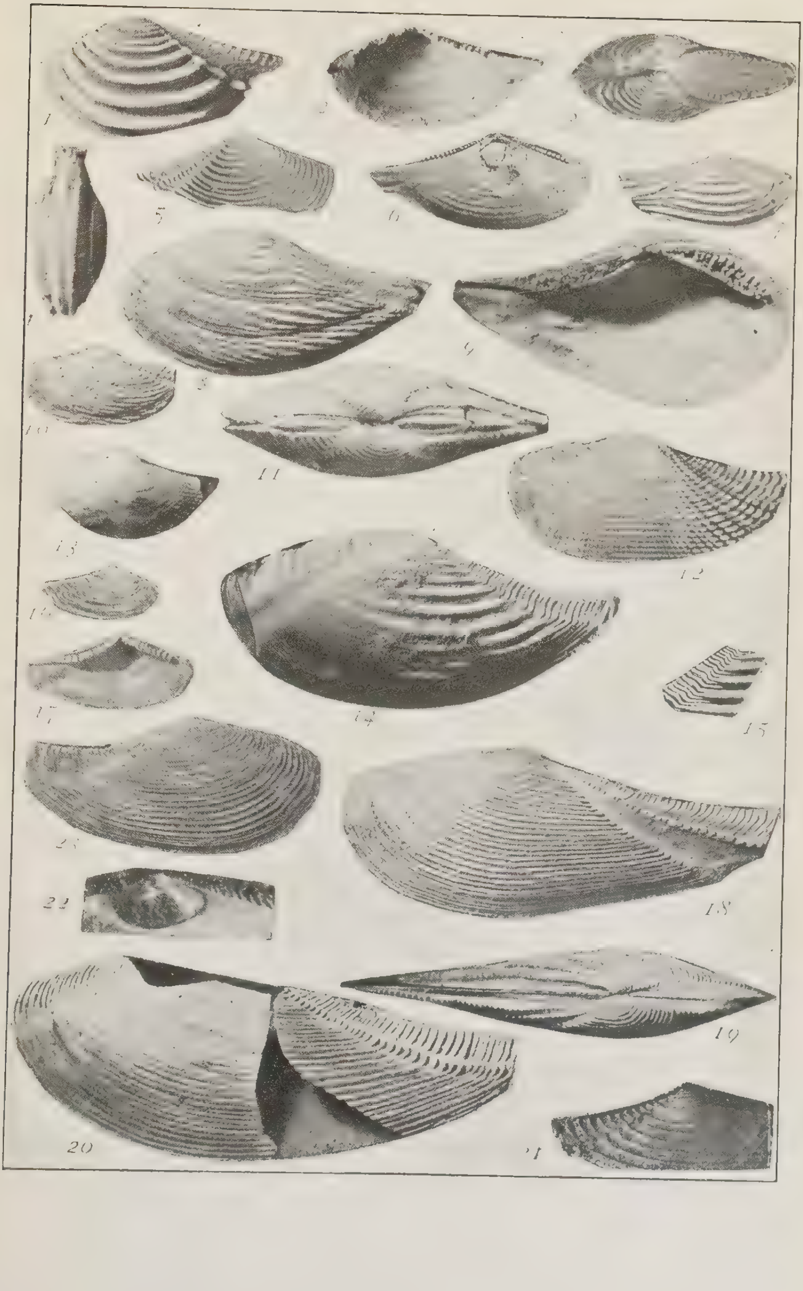
21, umbonal area × 4, Claiborne sand.
22, cartilage pit, &c, × 4, Claiborne sand.
23, var. *hammetti*, 24 mm., Hammett's Br., La.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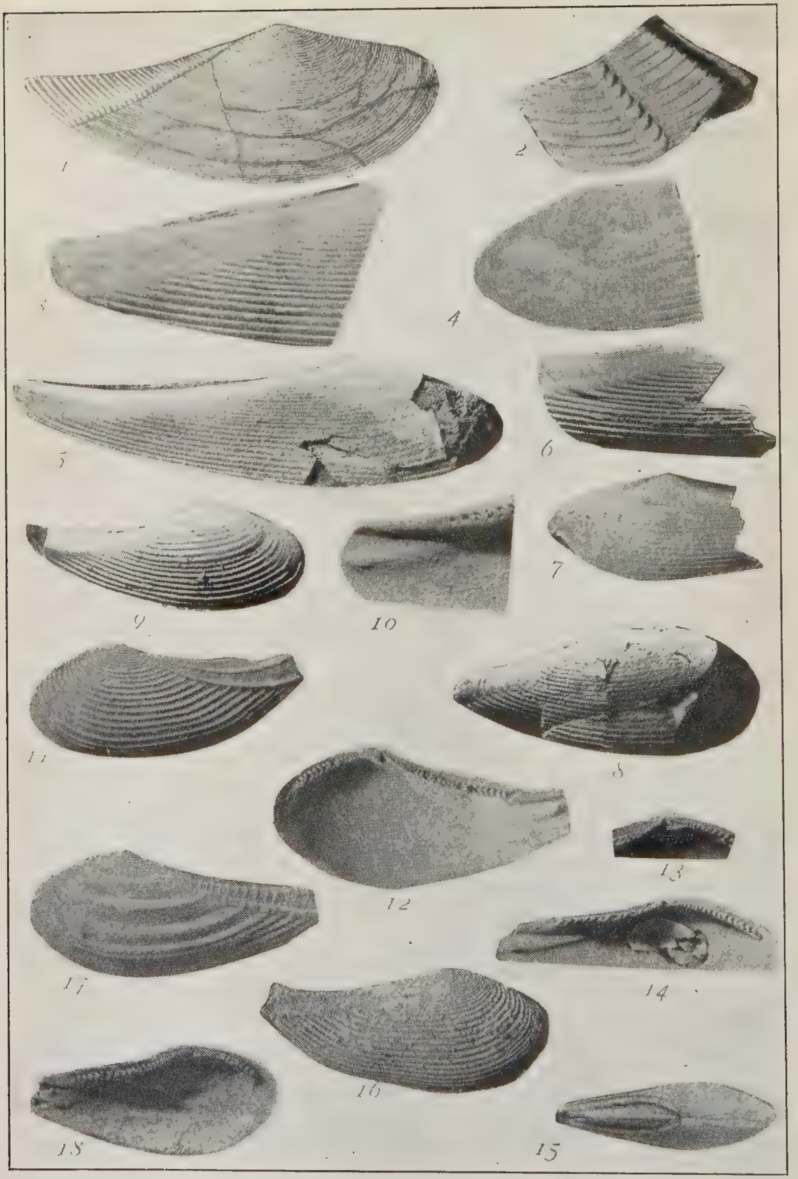
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## PLATE 24

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1, 2. *Leda opulenta*, var. *compsa* Gabb .......... 62
Fig. 1, 35 mm., Cedar Creek, Tex. ; Tex. State Museum.
2, fragment, × 3, Louisiana.

3-7. *Leda magna* Lea .......... 62
Fig. 3, 15 mm., posterior portion, Claiborne sand near St. Stephens ; Aldrich Coll.
4, 9 mm., anterior portion, same place as above.
5, var. *lisbonensis* Ald., 39 mm., Lisbon.
6 and 7, fragments 17 mm. long, from Lisbon.

8. *Leda magnopsis*, n. sp., 20 mm., .......... 64
Near Springfield, S. C.

9-10. *Leda bastropensis* Harris .......... 64
Fig. 9, 11 mm., type, Texas State Museum.
Fig. 10, fragment, interior, enlarged, Sabine River.

11-16. *Leda bella* Conrad .......... 64
Figs. 11 and 13, 8.3 mm., Claiborne.
12, 10 mm., Claiborne.
14, 6 " "
15, 5 " " Aldrich Coll.
16, 9.5 " 6 mi. W. N. W. of Orangeburg, S. C.

17-18. *Leda pistorupes*, n, sp .......... 65
Fig. 17, 7 mm., Baker's Bluff, Claiborne hor. ; Ald. Coll,
18, 6.2 " " " " "

## PLATE 25

Figure Page

1-4. *Leda media* Lea ........ 65
Fig. 1, 6.5 mm., Claiborne.
2, 9 " "
3, 6.5 " "
4, 6 " "

5, a. *Leda catasarca* Dall, 5 mm ........ 66
Wautubbee, U. S. Nat. Mus.

6. *Leda keittensis*, n, sp., 7.3 mm., U. S. Nat. Mus ........ 67

7-9. *Leda crassiparva*, n. sp. ........ 68
Figs. 7-8, 4.5 mm., Lisbon.
9, 4 " Ald. Coll.

10-14. *Leda ozarkola*, n. sp. ........ 68
Fig. 10, 6 mm., Hamilton Bluff.
11, 15 " " "
12, 15 " " "
13, 11 " " "
14, 20 " " "

15, a. *Leda wautubbeana*, n, sp. ........ 69
Fig. 15, 4.5 mm., Wautubbee.
15, a, 7.5 " Newton.

16. *Leda vanuxemi* Con., 22 mm., S. C. (Copy) ........ 70

17. *Leda carolinensis* Con., 12 mm., S. C. (Copy) ........ 70

18. *Leda subtrigona* Con., 18 mm., S. C. (Copy) ........ 70

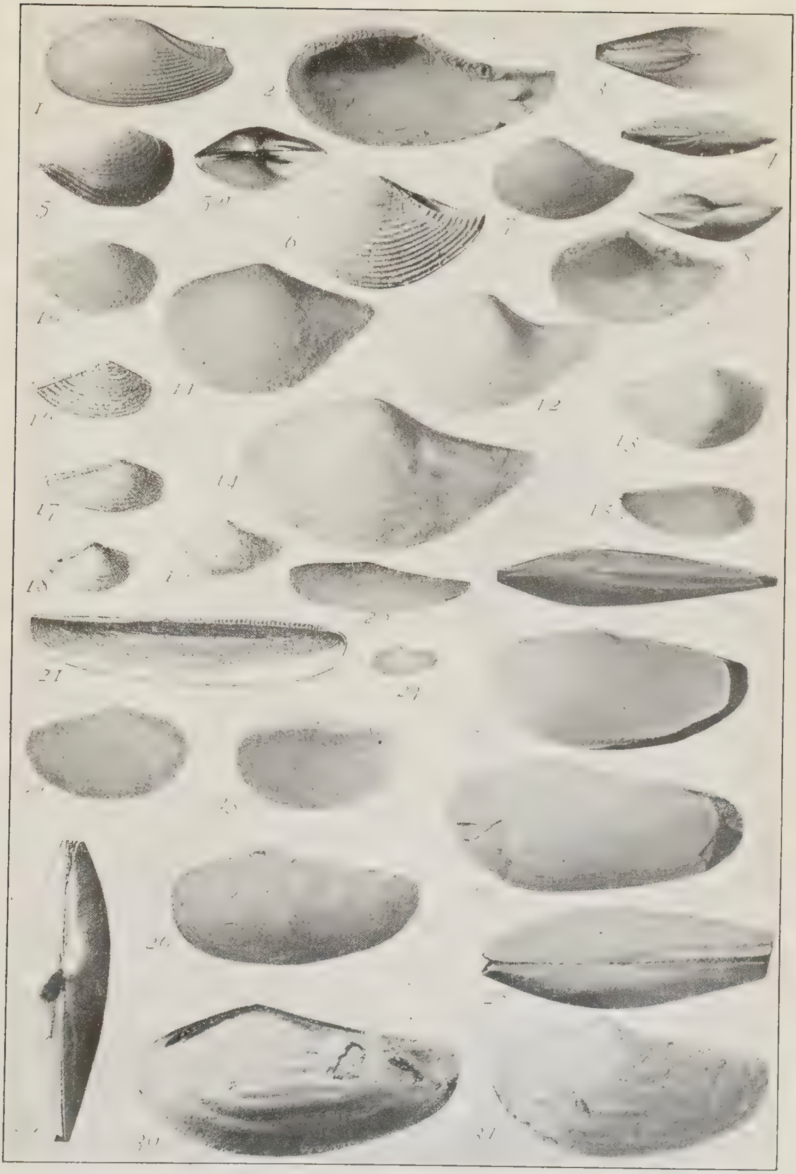
19. *Leda calcarensis* Con., 14 mm., S. C. (Copy). ........ 70

20-21. *Adrana adrichiana* Har. ........ 71
Fig. 20, 15 mm., Roberta, La.
21, 14 " Texas. (Copy) Tex. Mus.

22-23. "*Nucula capsiopsis*" de Greg., 5.3 mm ........ 71
Copied from Gregorio. Claiborne. Gregorio Coll.

24. *Yoldia claibornensis* Con., 10 mm. (Copy) ........ 72
Type lost.

25-31. *Yoldia psammotæa* Dall ........ 72
Fig. 25, 18 mm., smooth var., base of Claiborne bluff.
26, 21 " striate, Lisbon.
27, 22 " typical *psammotæa*, base of bluff.
28, 25 + mm., Keitt's Ravine, S. C. U. S. Nat. Mus.
29, 18 mm., Claiborne.
30, Var. *orangeburgensis*, n. var. 20 mm.; 5 mi. N. of Orangeburg, S. C.
31, the same, var. *vivianensis*, n. var., 14 mm., Vivian, La.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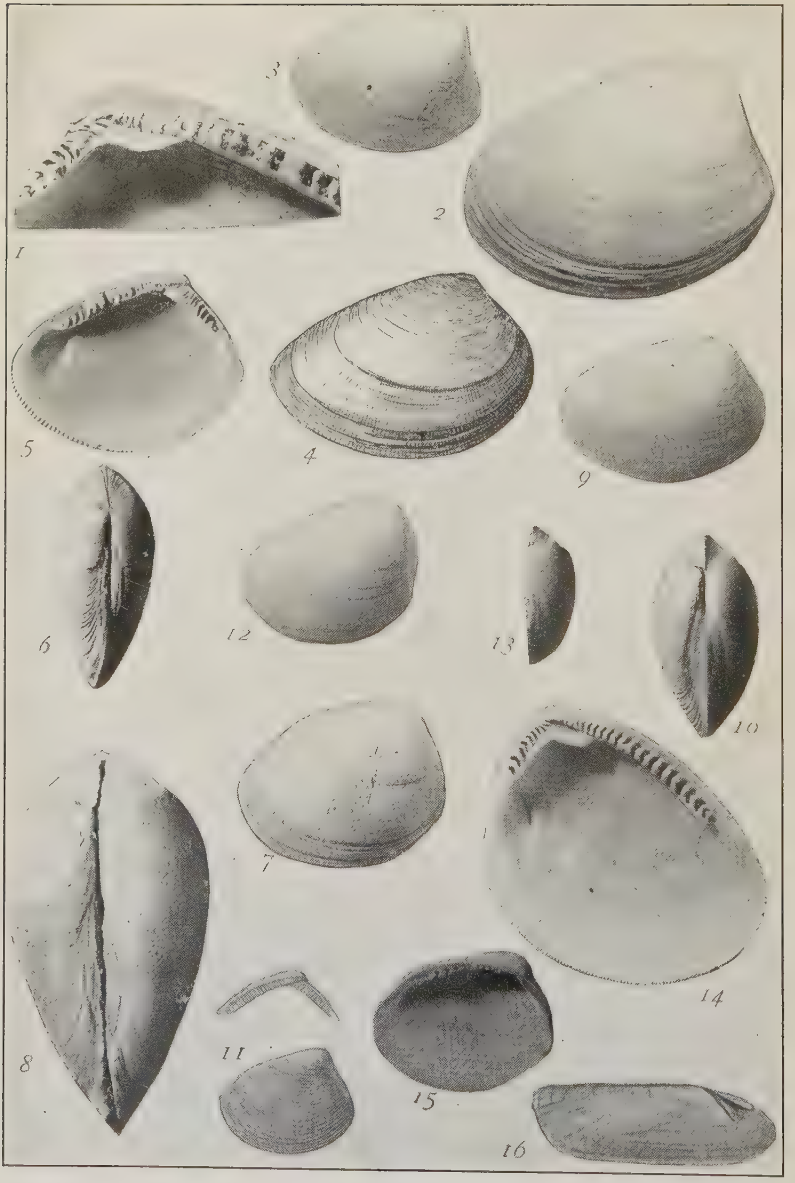
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## PLATE 26

| Figure | | Page |
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| 1-3, 8. | *Nucula magnifica* Conrad<br>Fig. 4, × 3, Claiborne sand.<br>5, 25 mm., “ “<br>6, 13 mm., “ “<br>8, 25 “ “ “ | 73 |
| 4-6. | The same, var. *mauricensis*, n. var.<br>Fig. 4, 17 mm., Elm Cr., Tex. Tex. State Mus.<br>5, 15 “ Base of Claiborne Bluff.<br>6, 15 “ “ “ “ | 74 |
| 7. | *N. magnifica*, var., 14 mm., from Hammett's Branch, La. | |
| 9-10. | *Nucula ripæ*, n. sp., 14 mm<br>From base of Claiborne bluff. | 74 |
| 11. | *Nucula monroensis* Ald., 21 mm. (Copy) | 75 |
| 12-14. | *Nucula ovula* Lea<br>Fig. 12, 13 mm., Claiborne sand bed.<br>13, 10 “ “ “<br>14, 12 “ “ “ | 75 |
| 15. | *Nucula*, sp. Miss. Undescribed. | |
| 16. | *Solemya alabamiensis* Har., 33 mm<br>Orangeburg Dist., S. C. | 76 |

## PLATE 27

Figure Page

1-6. *Venericardia planicosta* Lamarck........................................ 77

Fig. 1, var. "*densata*" Con., 35 mm., Lisbon.

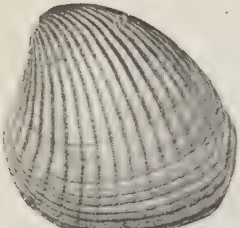
2, var. "*densata*" Con., 60 mm., base of Claiborne Bluff. Close to the European *planicosta*, especially those obtained from the Bracklesham beds of southern England.

3, the same, 40 mm.

4, Var. "*mooreana*" Con., 40 mm., Smithville, Tex.

5, 68 mm, Claiborne sand variety.

6, 70 " " " " This is the large, little specialized form abundant in the Claiborne sand and in the Jackson beds of the Mississippi Embayment. It differs but little from some of the earliest Midway specimens, except that it grows larger and shows an obsolescence of costation peripherally. But this latter feature is not shown on young specimens (see pl. 28, fig. 1.)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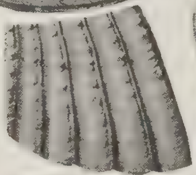
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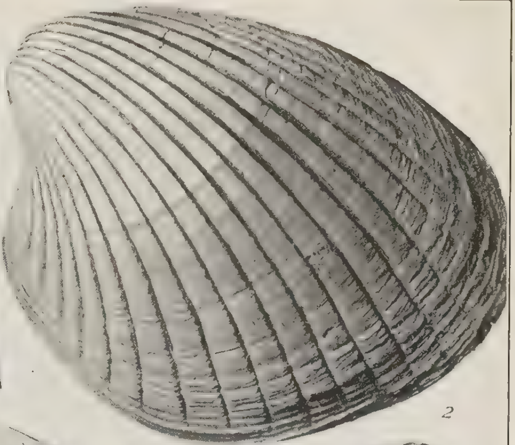
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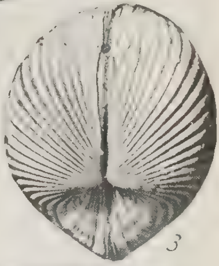
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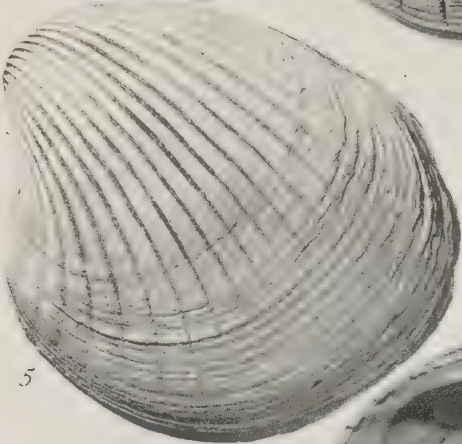
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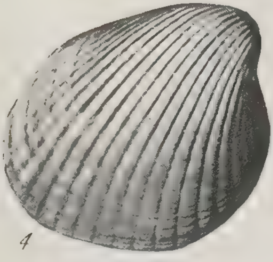
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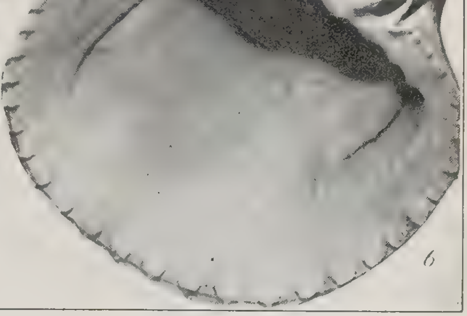
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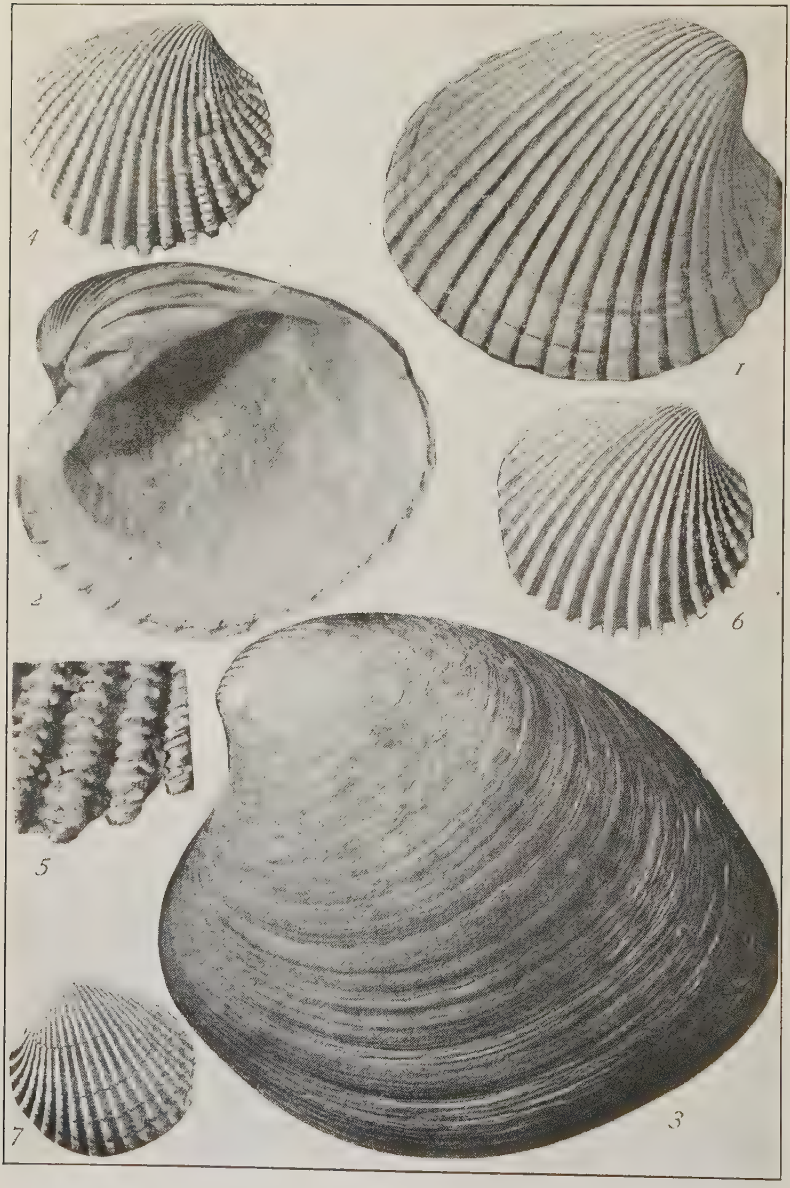
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## PLATE 28

Figure — Page

1-3. *Venericardia planicosta* Lamarck........................................ 77

Fig. 1, 60 mm., the typical primitive stock from which many American varieties have arisen, likewise the European "type" of the species ; occurring at all horizons from the Midway to the Jackson inclusive. Specimen from the Claiborne "sand".

2, 62 mm., Claiborne.

3, the variety we have usually designated by the Greek letter $\gamma$, (gamma). Large (98 mm.). From upper Sabine and St. Maurice horizons. Referred by Dall to *hornii* Gabb. Lisbon, Ala. For interior see next plate.

4-7. *Venericardia rotunda* Lea................................................ 78

Fig. 4, 20 mm., variation with imbricate crenulation styled here *fungina*. Claiborne sand.

5, specimen × 4, showing character of crenulæ.

6, 30 mm., form with few crenulations on narrow ribs, here called *funiculus*. From the Claiborne sand bed.

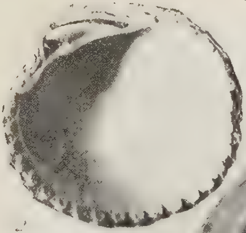
7, 28 mm., same as fig. 6, but showing the usual stage of erosion of Claiborne sand specimens.

## PLATE 29

Figure Page

1. *Venericardia planicosta* var. *gamma*.......................................... 77
Lisbon. See pl. 28 for exterior.

2-8. *Venericardia rotunda* Lea..................................................... 78
Fig. 2, 18 mm., var. *fungina*, n. var. Claiborne.
3, 20 " var. *funiculus*, n. var. "
4, 19 " dorsal view. "
5, 19 " showing characteristic serration of sub-ligamental costæ. Claiborne.
6, 14 mm., var. approaching *trapaquara* Har. Wautubbee.
7, 12 " the same. Wautubbee.
8, 22 " var. *flabellum*, n. var. Smithville.
9, *Venericardia* (*rotunda ?*, var.) *coloradonis*, n. var., 21 mm., Smithville Tex. Whether this is more nearly related to the *rotunda* or *alticostata* forms we have been unable to decide. See p. 81.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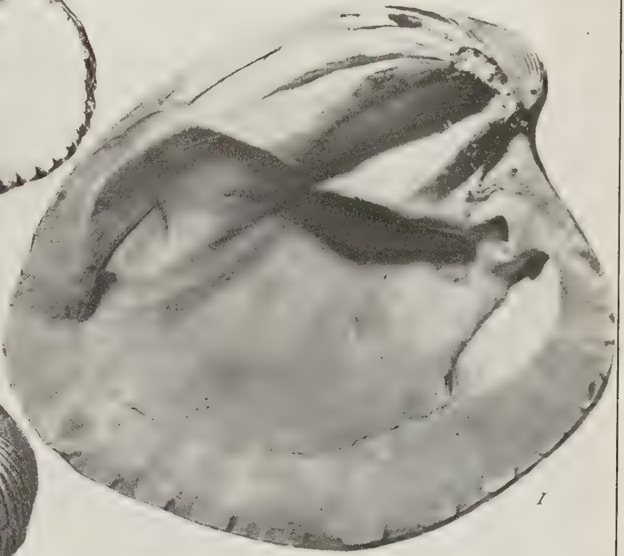
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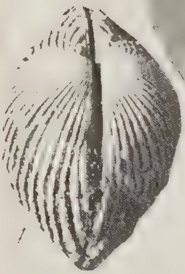
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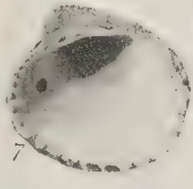
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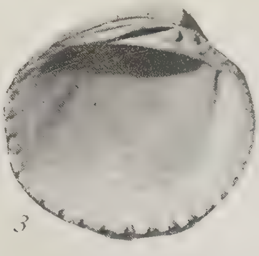
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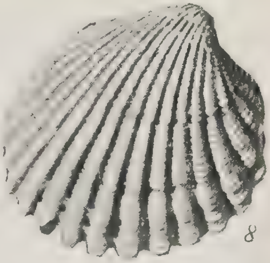
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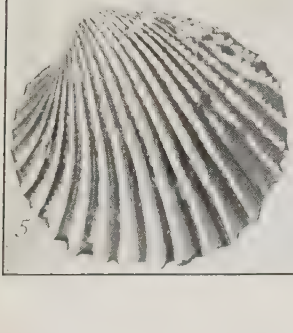
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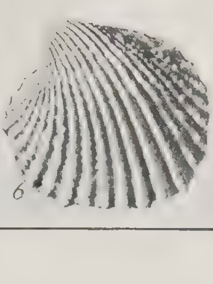
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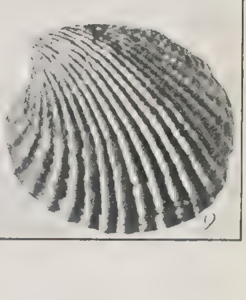
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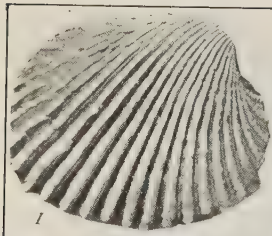
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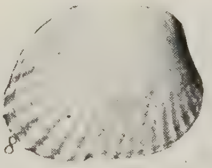
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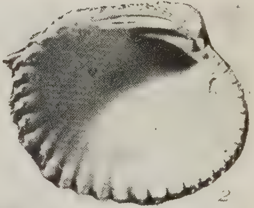
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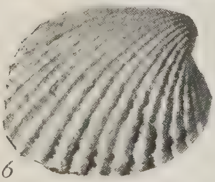
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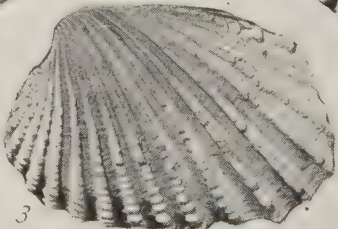
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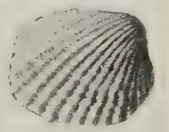
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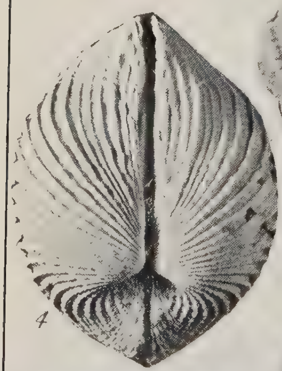
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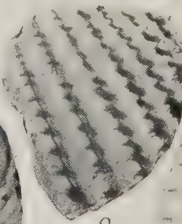
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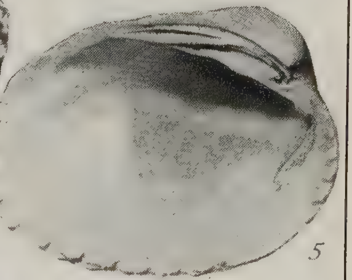
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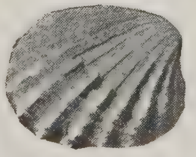
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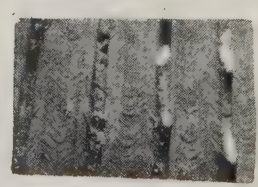
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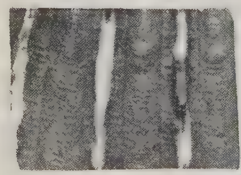
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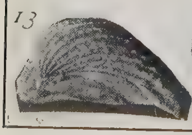
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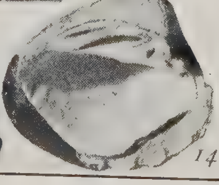
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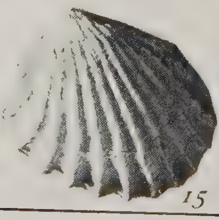
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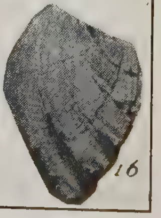
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## PLATE 30

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1-5. *Venericardia alticostata* Conrad........................................ 82

Fig. 1, 34 mm., form of *sillimanni* Lea. Claiborne.

2, 19 " a still shorter form, but showing pronounced sub-ligamental costation exteriorly. Claiborne.

3, 41 mm., practically the form described as *transversa* by Lea.

4, 48 mm., large transverse form, showing the fourth rib below the ligamental margin to be the largest of all on the post-umbonal slope. Claiborne.

5, 45 mm., interior of a large transverse typical Claiborne form.

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Fig. 6, 14 mm., approaching *carsonensis*. Wautubbee.

7, 13 " Clear Lake, La.

8, 11 " type specimen. Tex. Museum.

9, × 2.5, showing crenulæ well preserved. Wautubbee.

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Fig. 10, 16 mm.. Natchitoches, La.

13-16, × 1.5 ., fragments showing surface and hinge characters. Natchitoches, La.

11. *Venericardia wilcoxensis* Dall ..... ........................................ 85

Showing the U-shaped inter-costal spaces with well-developed microscopic granules. From the Midway Eocene at Matthew's Landing, Ala.

12. *Venericardia alticostata* Conrad. Showing the narrow, almost V-shaped intercostal spaces with microscopic granules. Claiborne.

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6. *Venericardia inflatior* Mr. 87
Copy. Enlarged about three-fold. Claiborne. Aldrich Coll.

7. *Venericardia subquadrata* Con. 86
Copy. Length 15 mm. Orangeburg Dist. Lost.

8. *Venericardia bilineata* Con. 86
Copy. Length 20 mm. Orangeburg Dist. Lost.

9. *Venericardia subrotunda* Con. 86
Copy. Length 8 mm. Orangeburg Dist. Lost.

10. *Venericardia viginitaria* Con. 86
Copy. Length 22 mm. Orangeburg Dist. Lost.

11, a. *Venericardia blandingi* Con. 86
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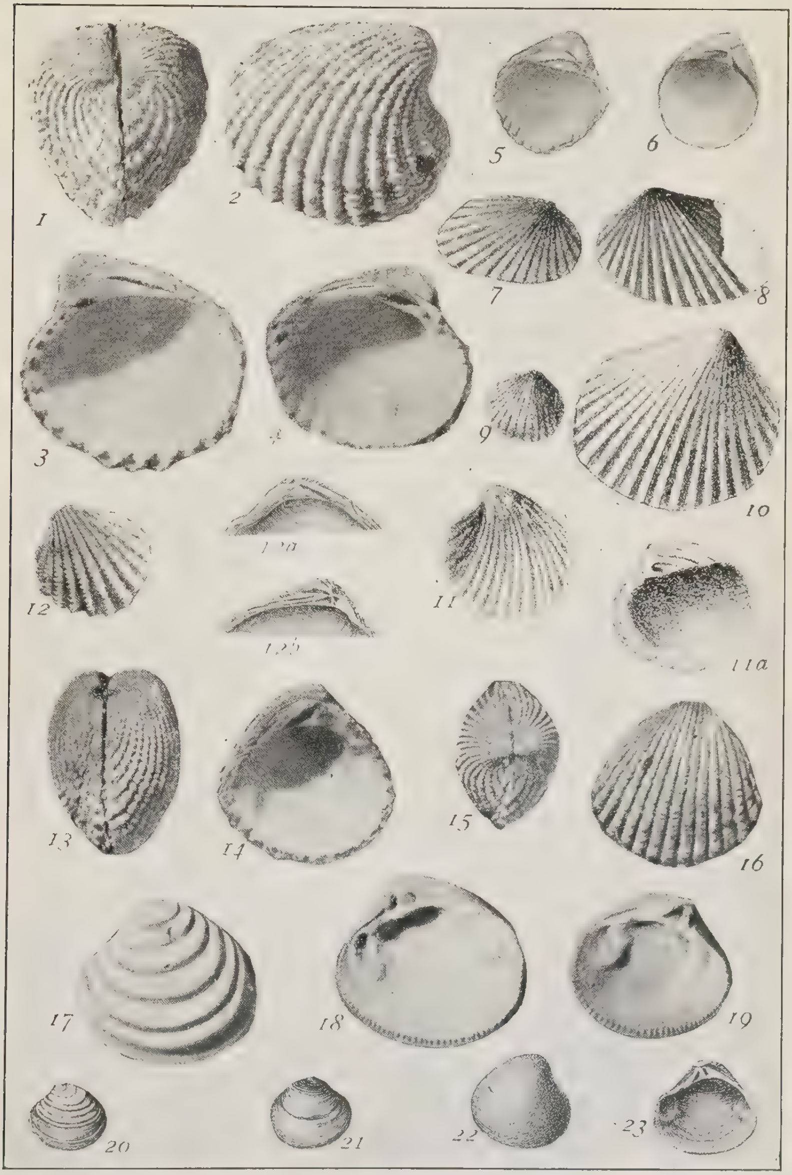
a, × 5, Lisbon.
b, × 4, Lisbon.

13-16. *Venericardia parva* Lea, × 4 88
Claiborne, Ala.

17-23. *Lirodiscus smithvillensis* Harris 89
Fig. 17, 16 mm., Smithville.
18, 17 " "
19, 14 " "
20-23, natural size ; Collier's Ferry, Burleson Co., Tex.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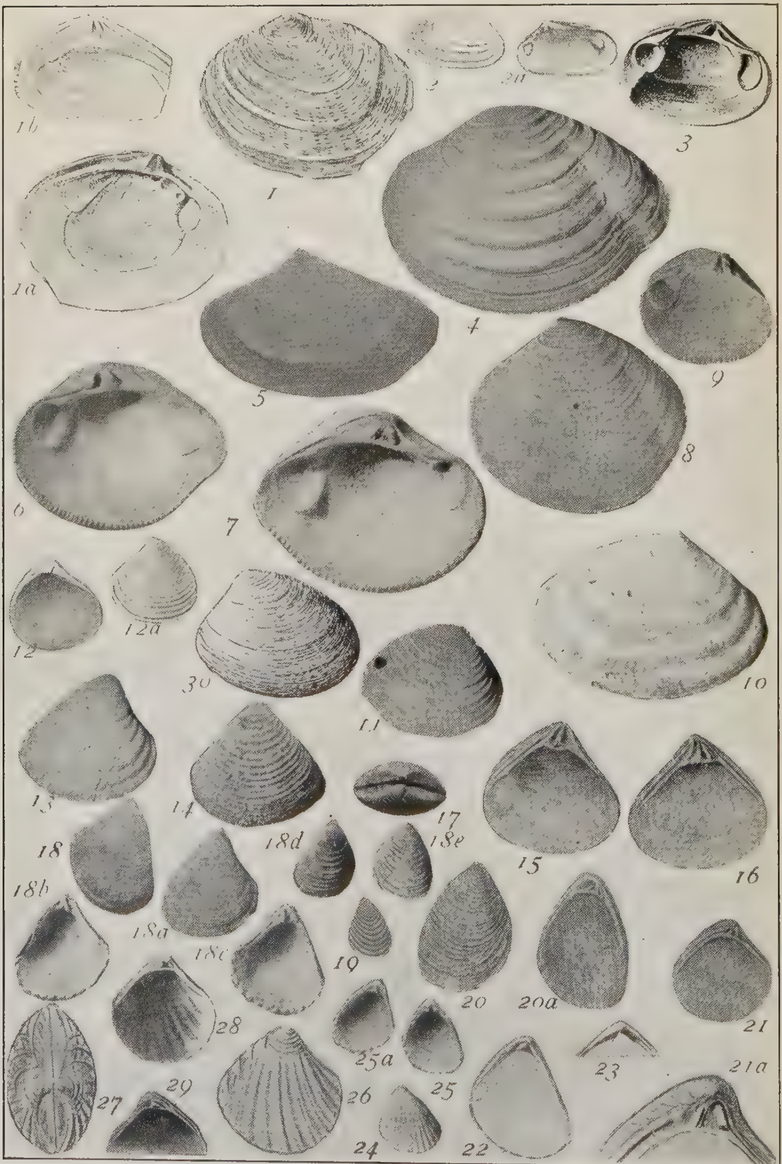
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| | Copy, Enterprise, Miss., Aldrich Coll. | |
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| | Copy. "Claiborne sand." U. S. Nat. Mus. | |
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| | 7, 20 " | |
| | 8, 17 ' | |
| | 9, 11.5 " | |
| | 10, 6 " | |
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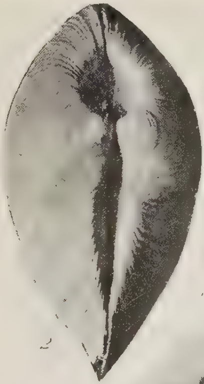
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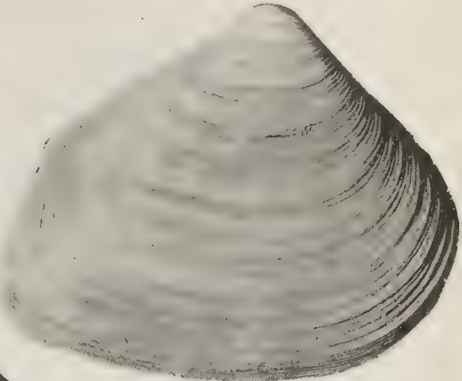
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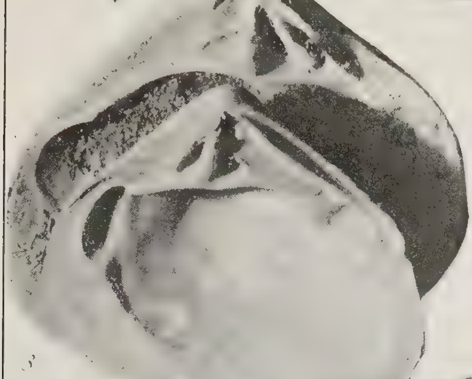
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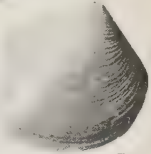
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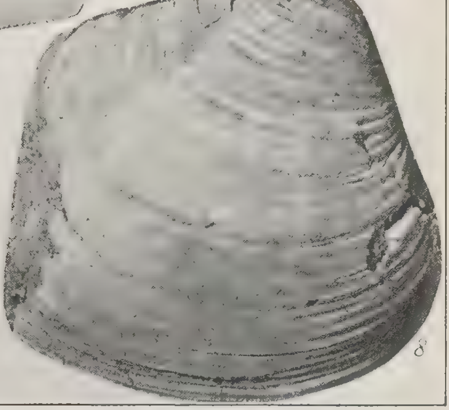
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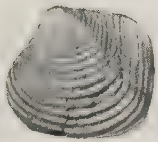
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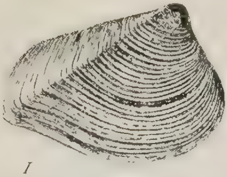
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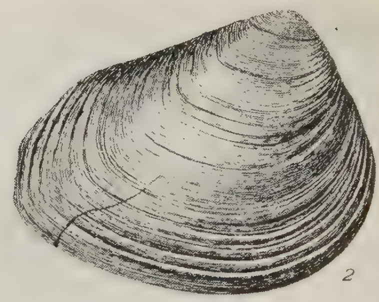
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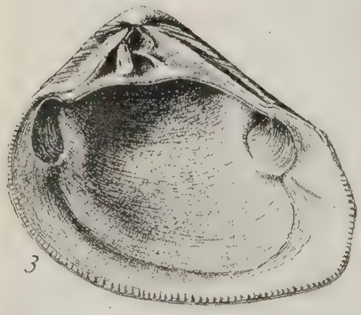
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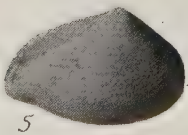
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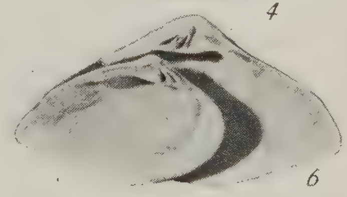
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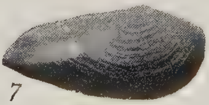
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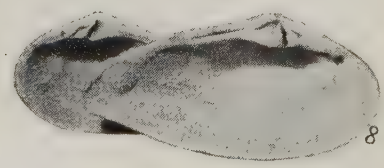
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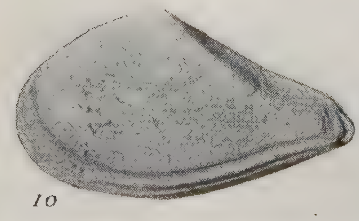
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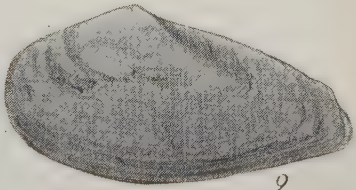
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1. *Crassatellites texanus* Heilp., 30 mm........................................ 97
North Boundary of Murchison Headright, Tex. Tex. State Museum.

2-3. *Crassatellites antestriatus* Gabb, 45 mm.................................... 98
Lee Co., Tex. Singley's Coll.

4. "*Crassatellites rhomboideus*" Conrad, 50 mm............................. 99
Orangeburg Dist. ? S. C.

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7, (left) 20 "

7-10. *C. clarkensis* var. *ferrocarolinus*, n. var................................. 100
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10, 35 mm., nasute form, Orangeburg Dist., S. C.

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1-5. *Crassatellites protextus* Conrad, Claiborne.................................. 101
Fig. 1, 45 mm., showing umbonal markings, lunule, &c.
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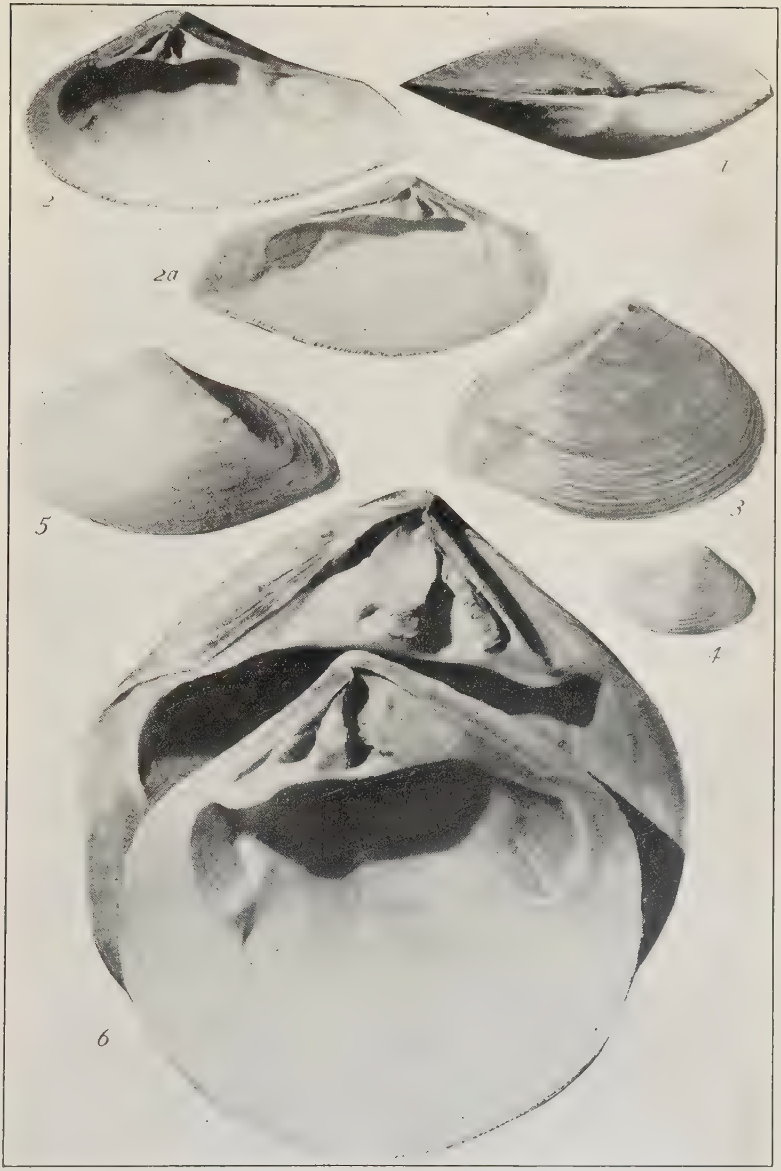
3, 40 " broad form.
4, 18 " young, showing concentric ribbing and sinuosity.
5, 40 mm., typical.

6. *Crassatellites altus* Conrad, Claiborne sand.................................. 104
Right valve 82 ; left, 97 mm.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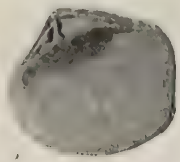

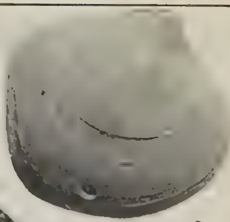

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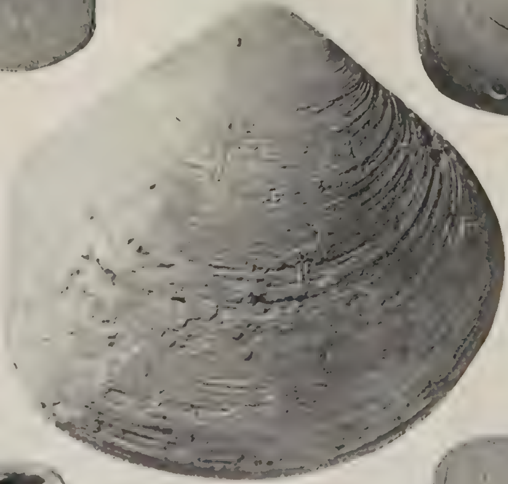

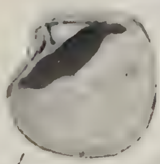

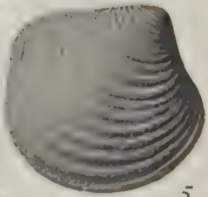

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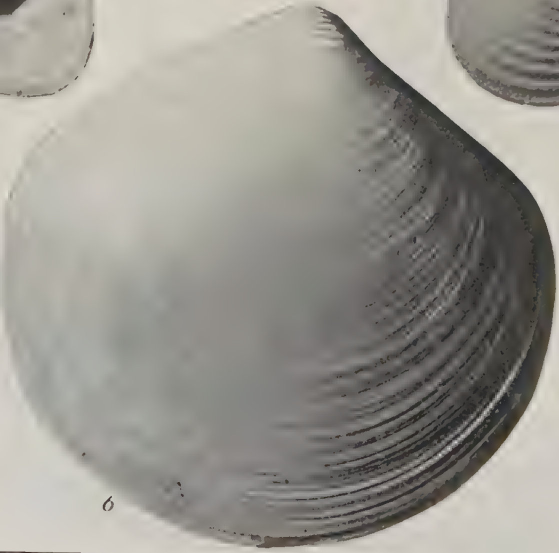

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1-3. *Crassatellites texaltus* Harris.................................................. 103
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2, 3, young specimen enlarged about 2 and 3 diameters

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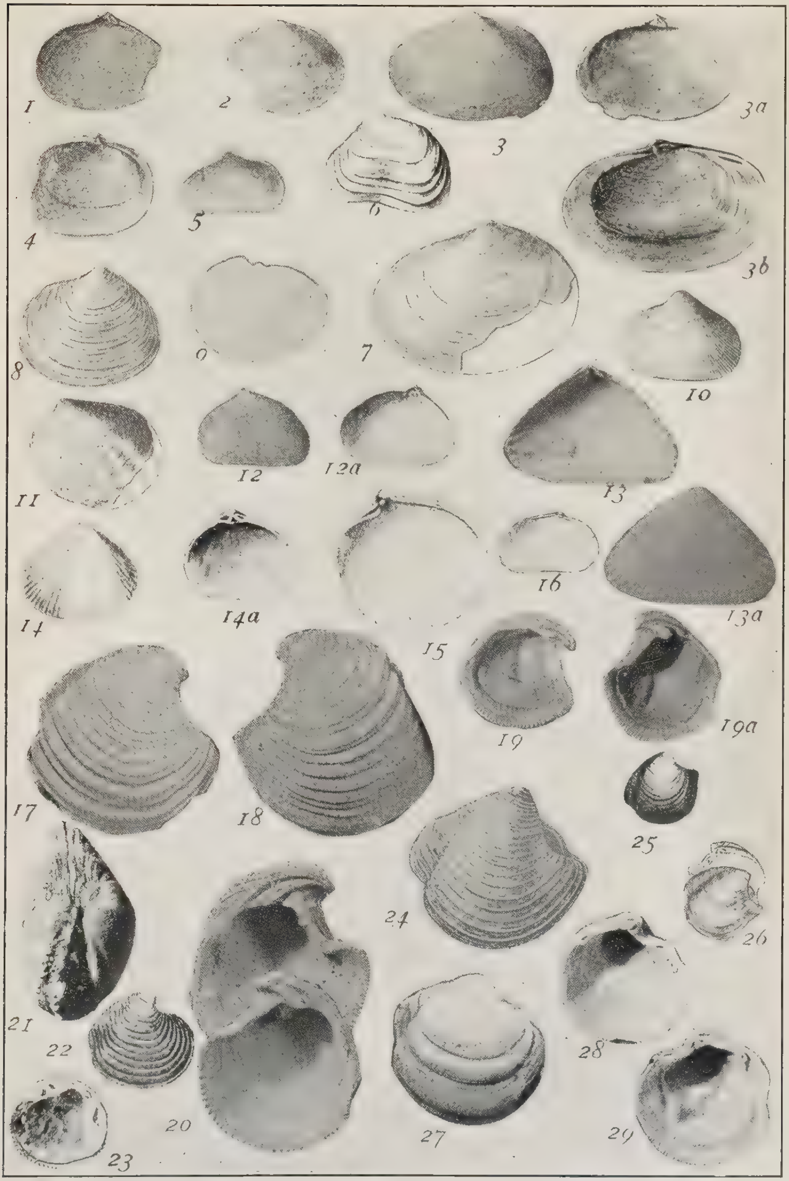
(Copy).
27, 8.3 mm.
28, 7 "
29, 7.2 " Specimens of the form usually collected at Claiborne.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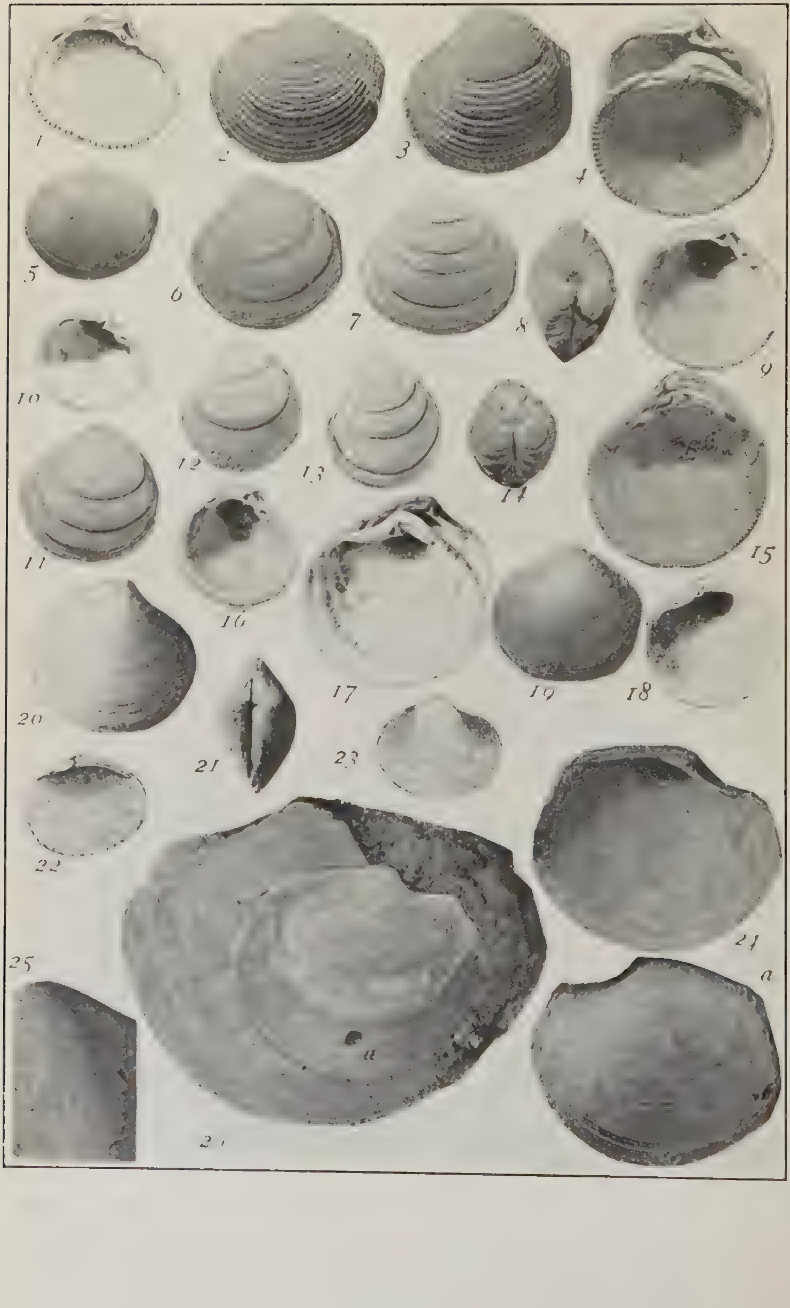
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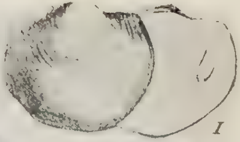
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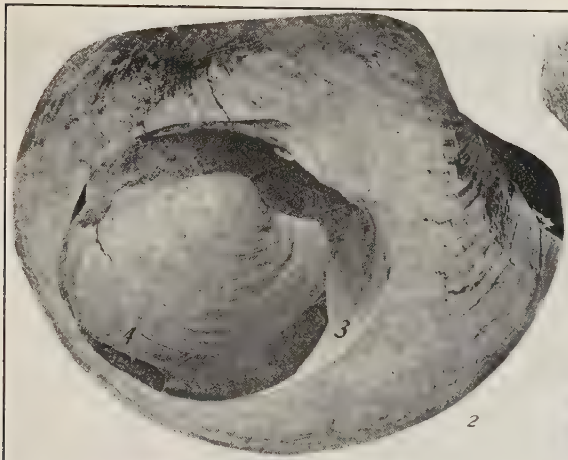
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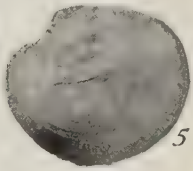
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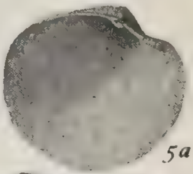
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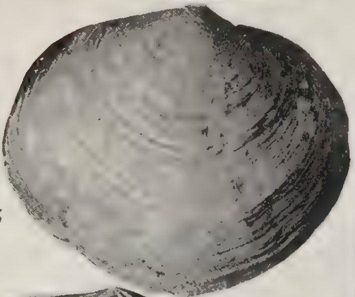
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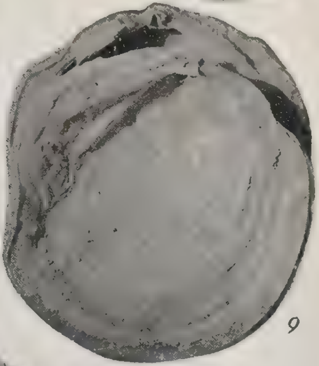
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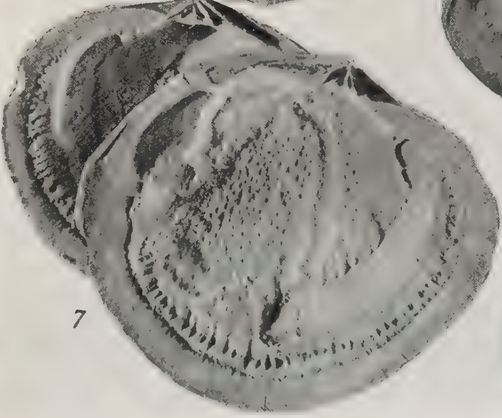
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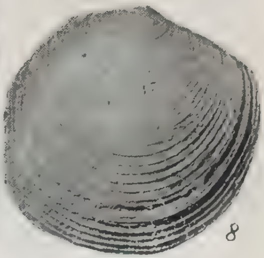
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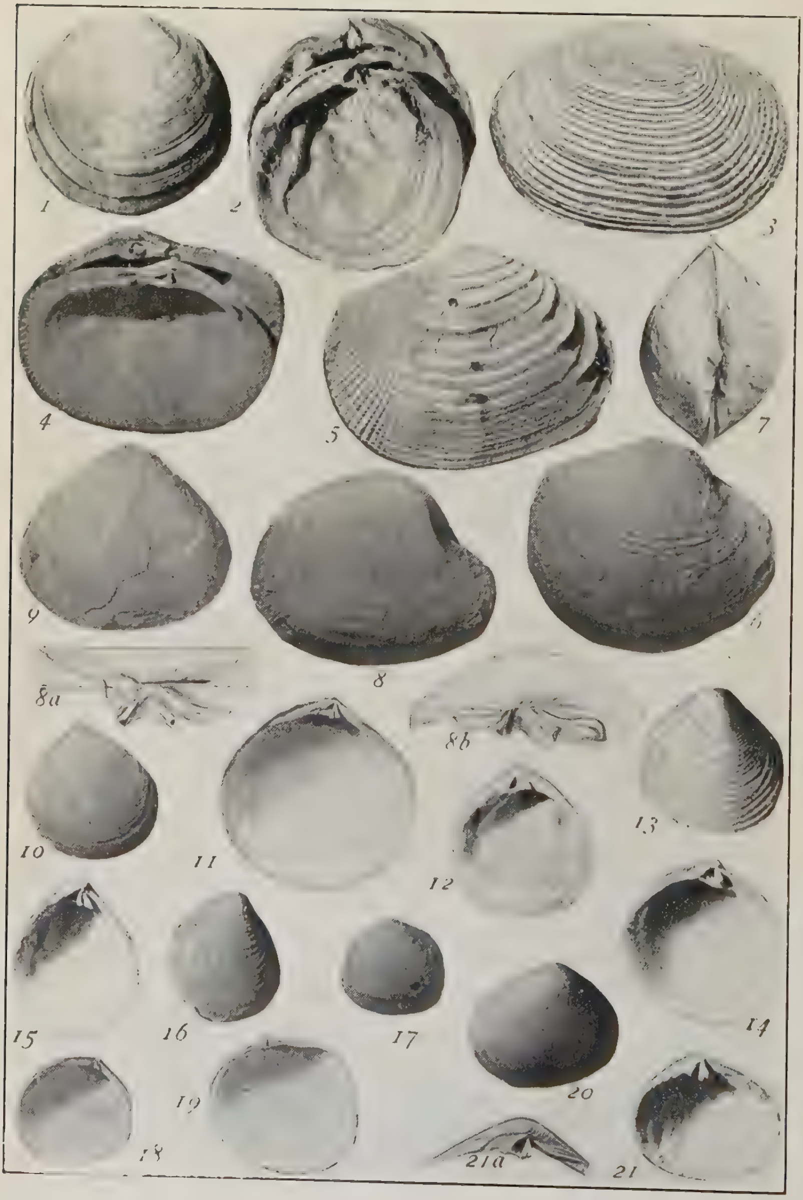
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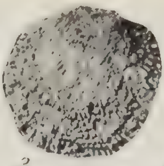
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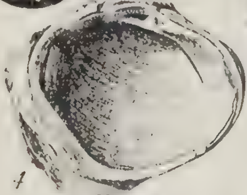
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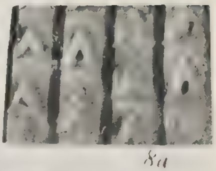
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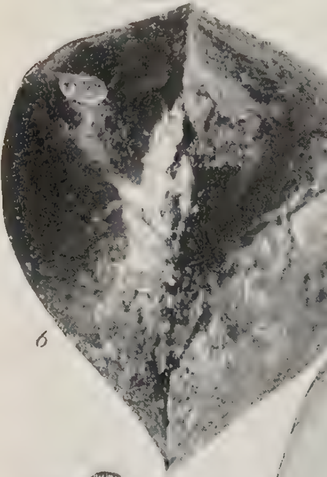
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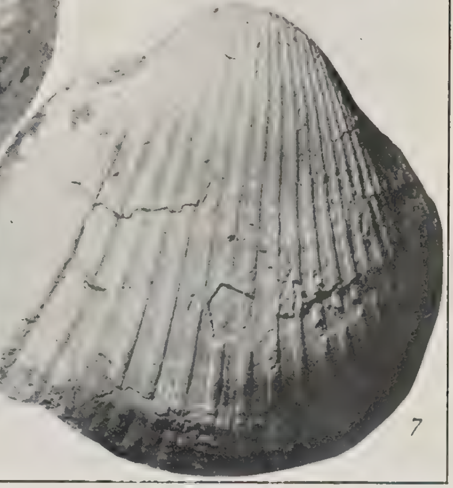
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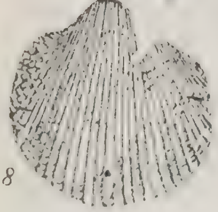
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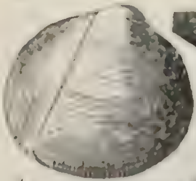
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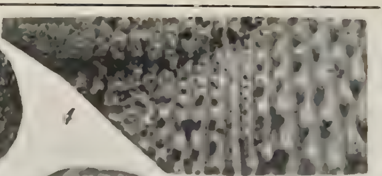
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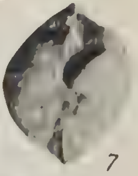
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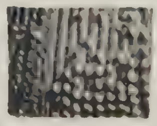
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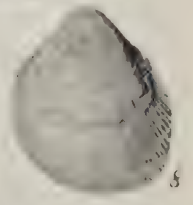
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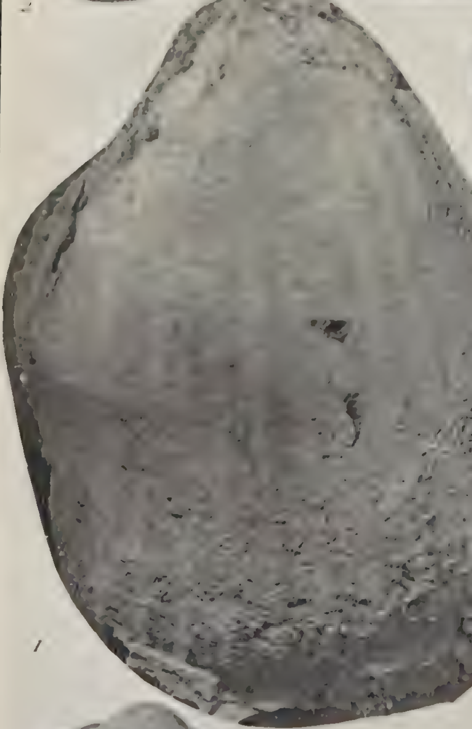
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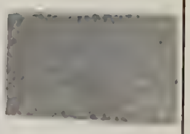
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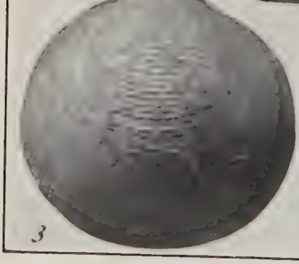
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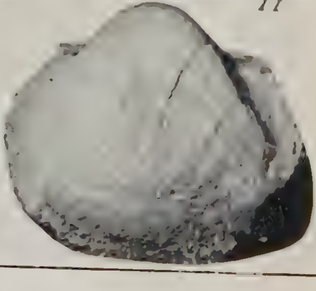
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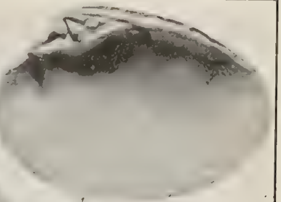
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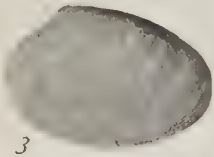
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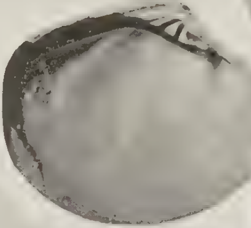
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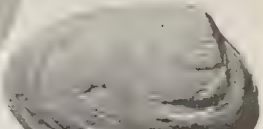
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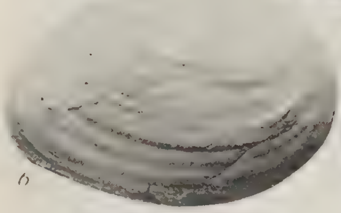
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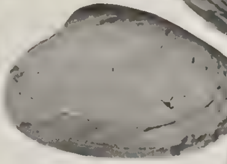
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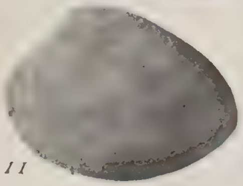
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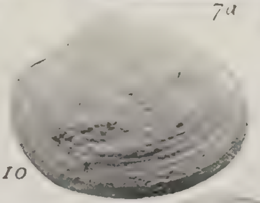
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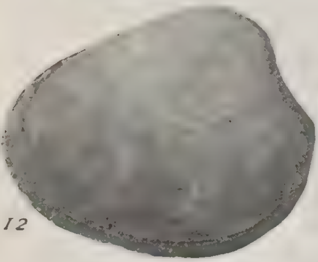
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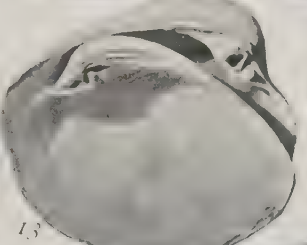
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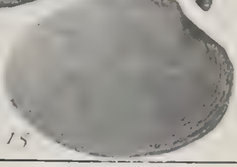
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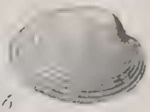
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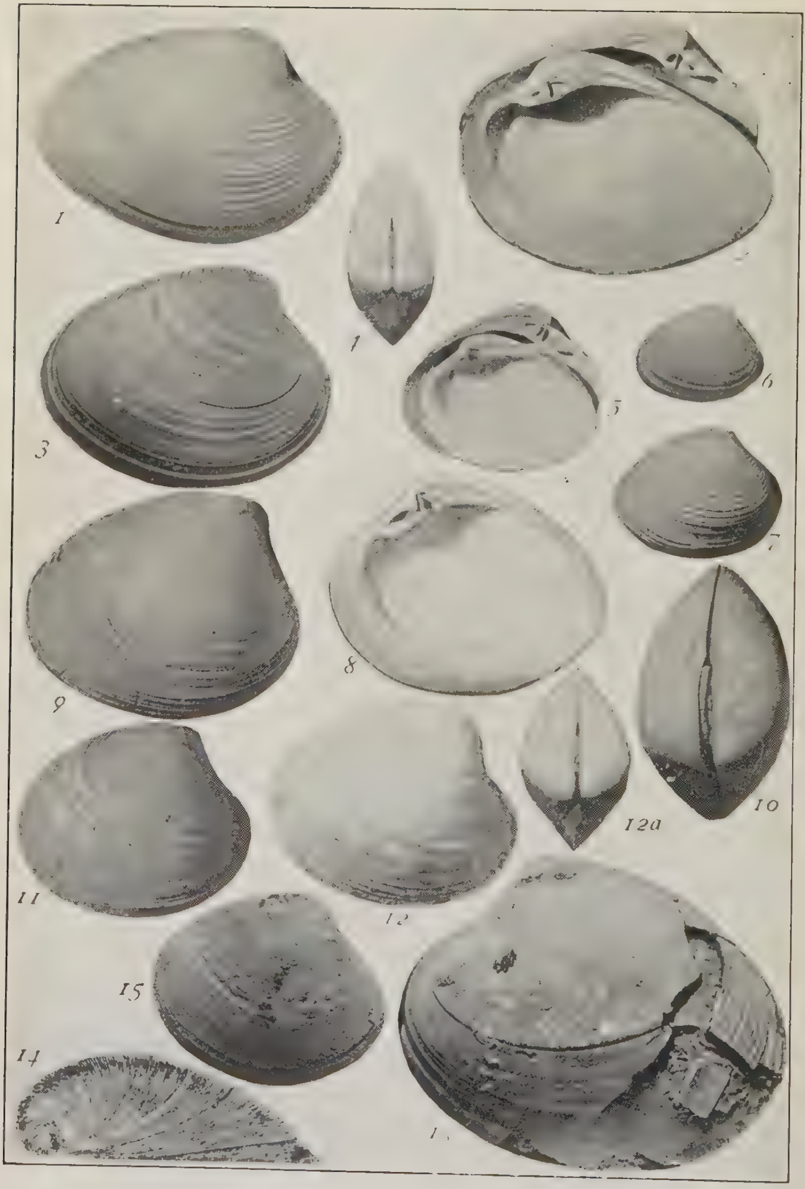
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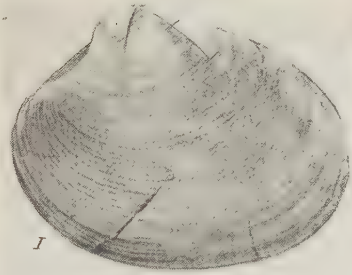
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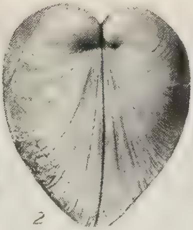
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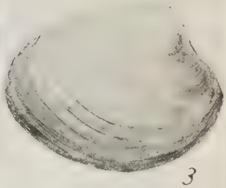
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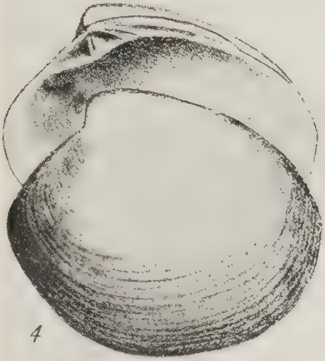
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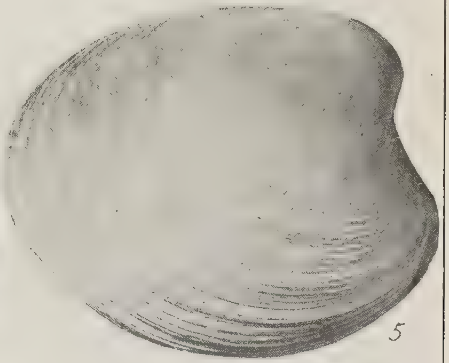
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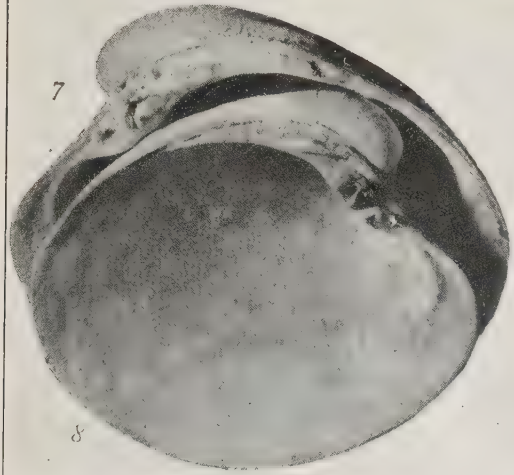
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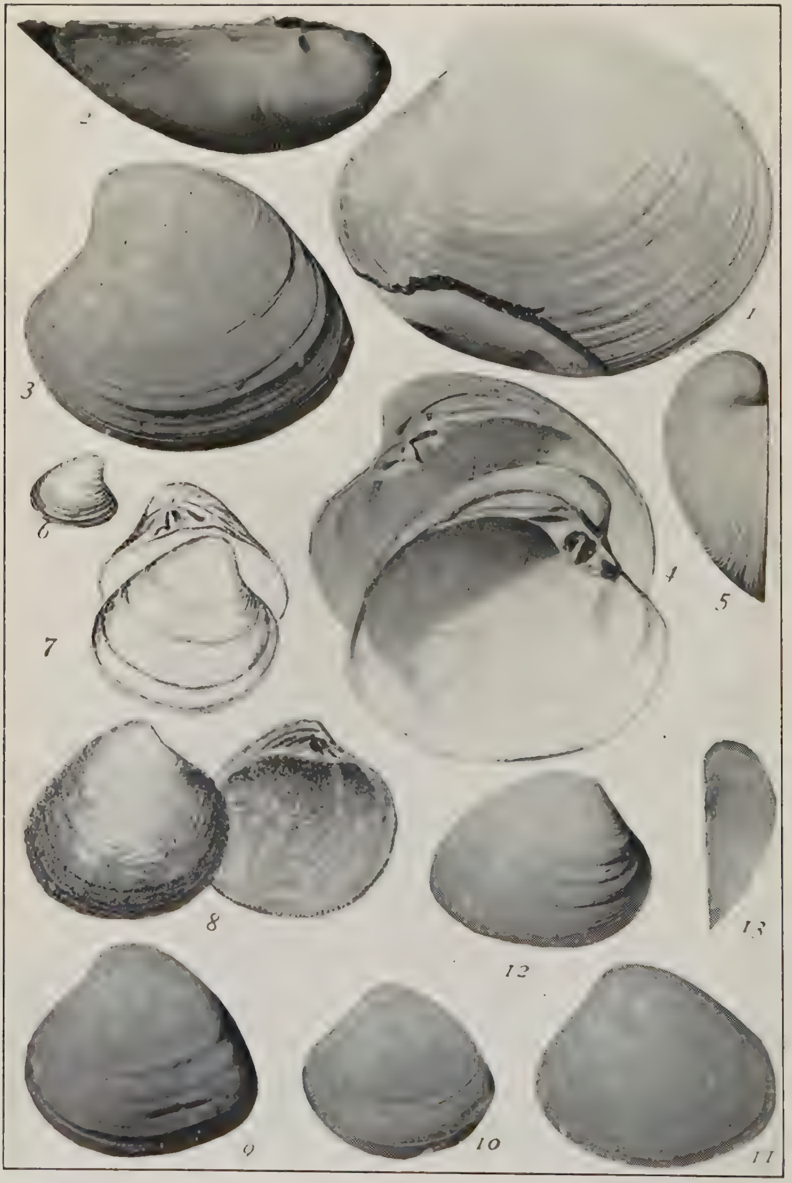
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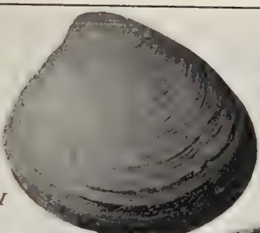
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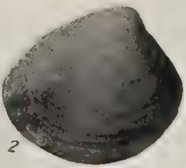
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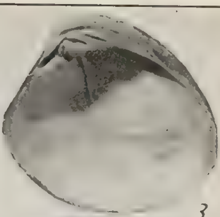
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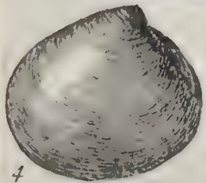
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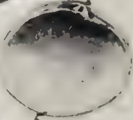
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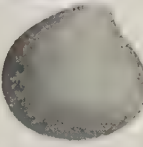
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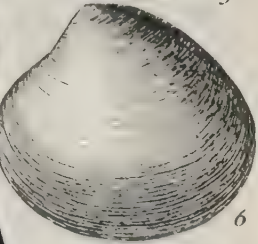
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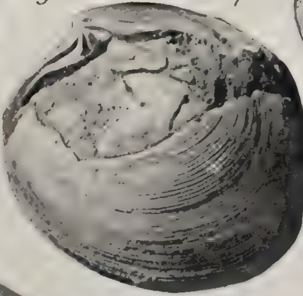
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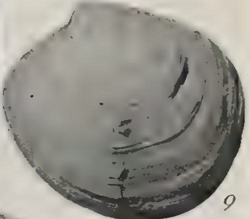
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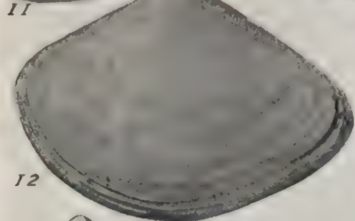
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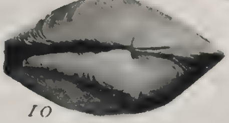
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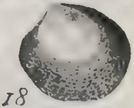
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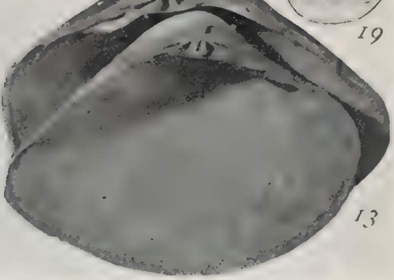
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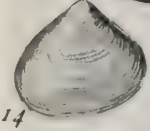
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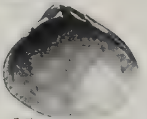
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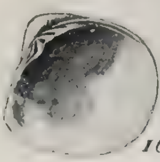
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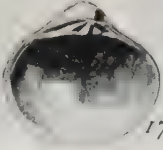
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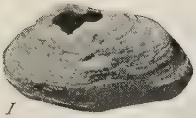
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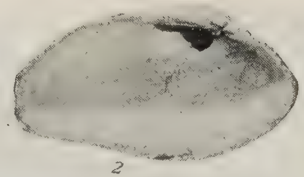
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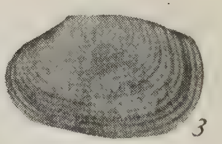
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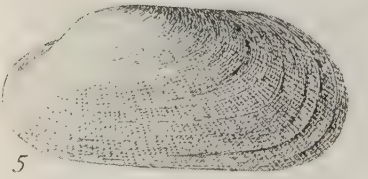
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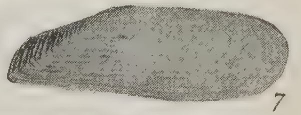
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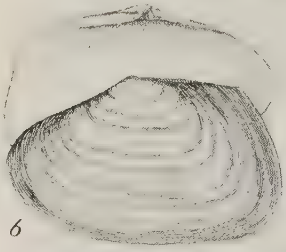
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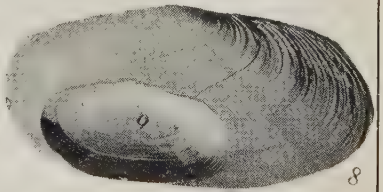

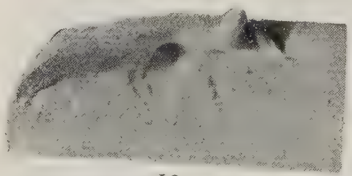
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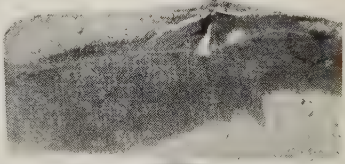
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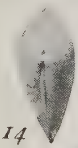
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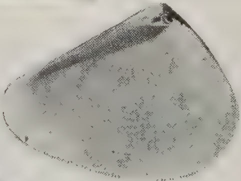
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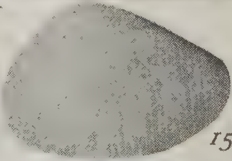
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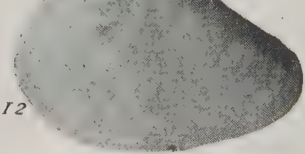
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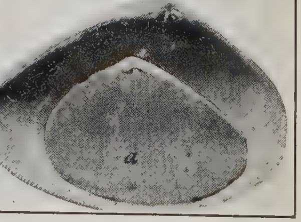

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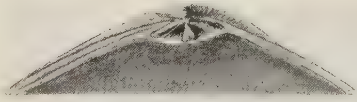
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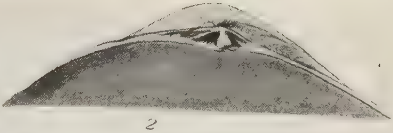
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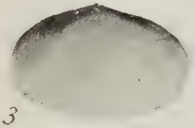
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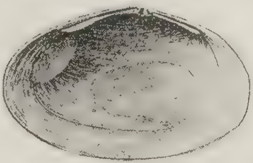
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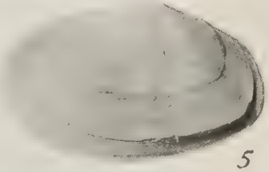
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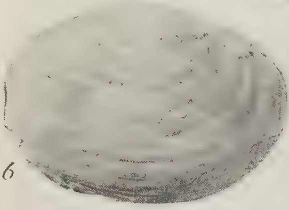
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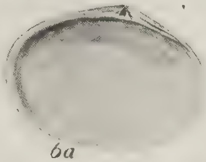
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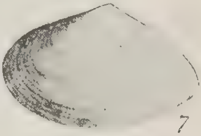
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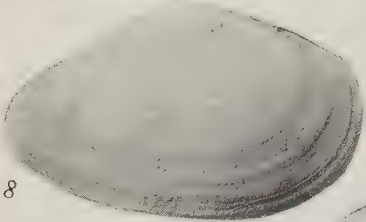
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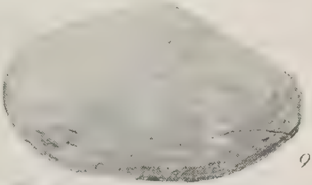
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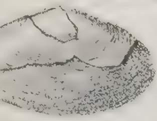
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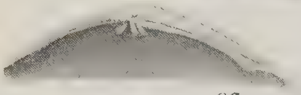
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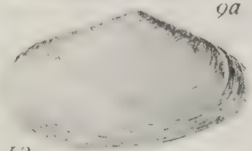
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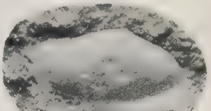
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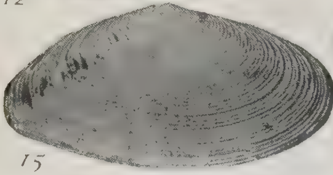
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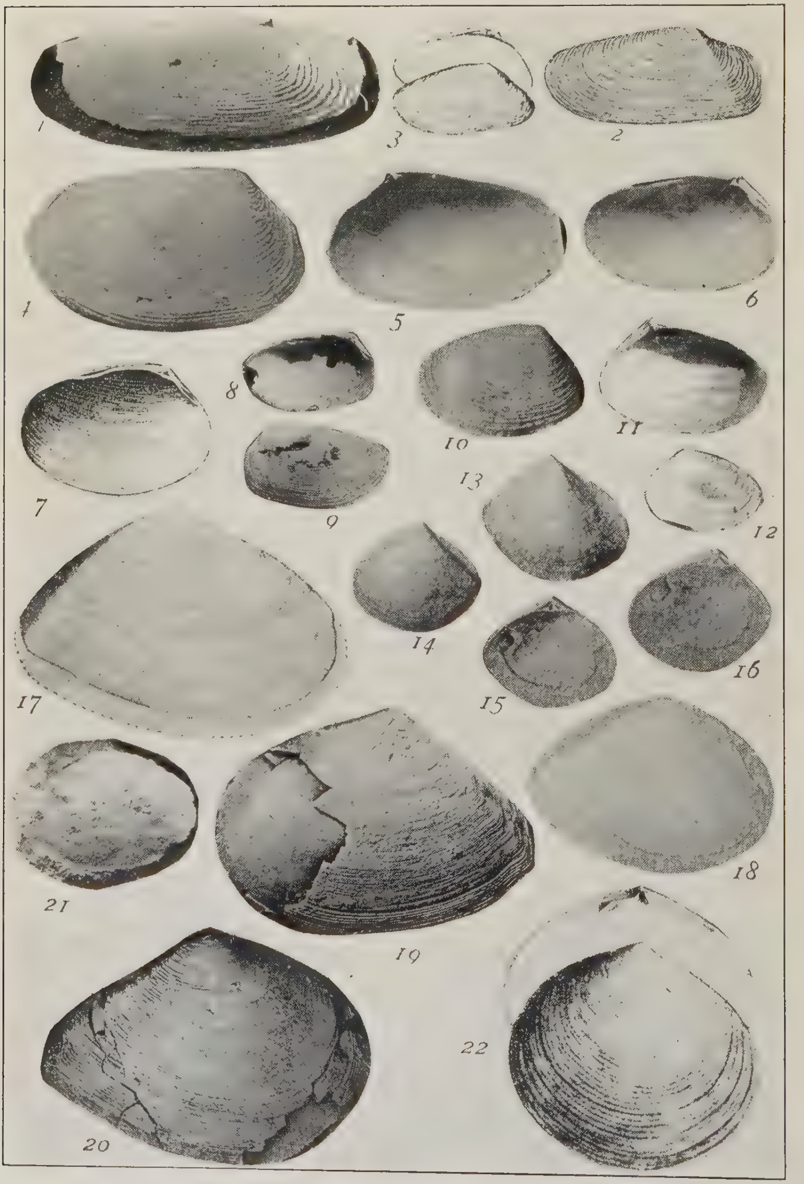
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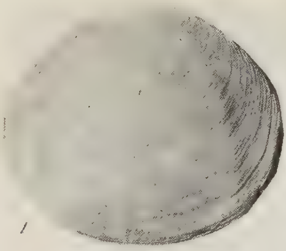
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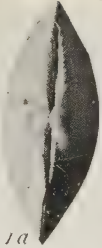
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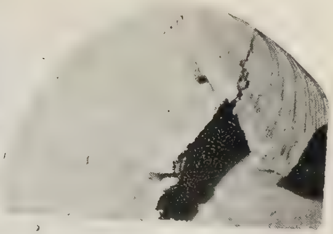
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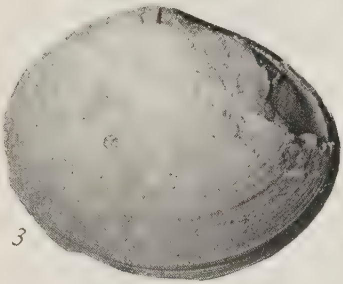
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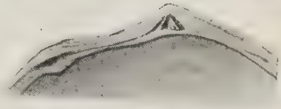
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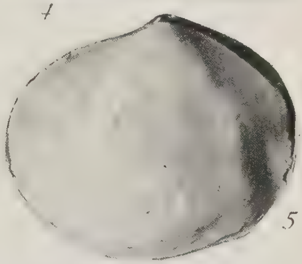
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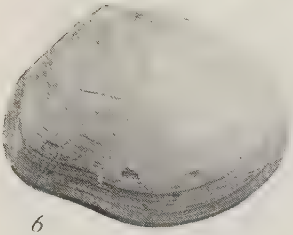
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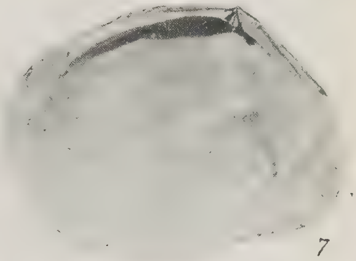
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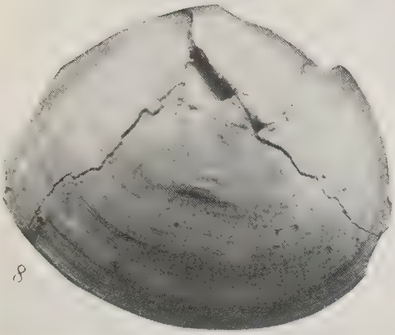
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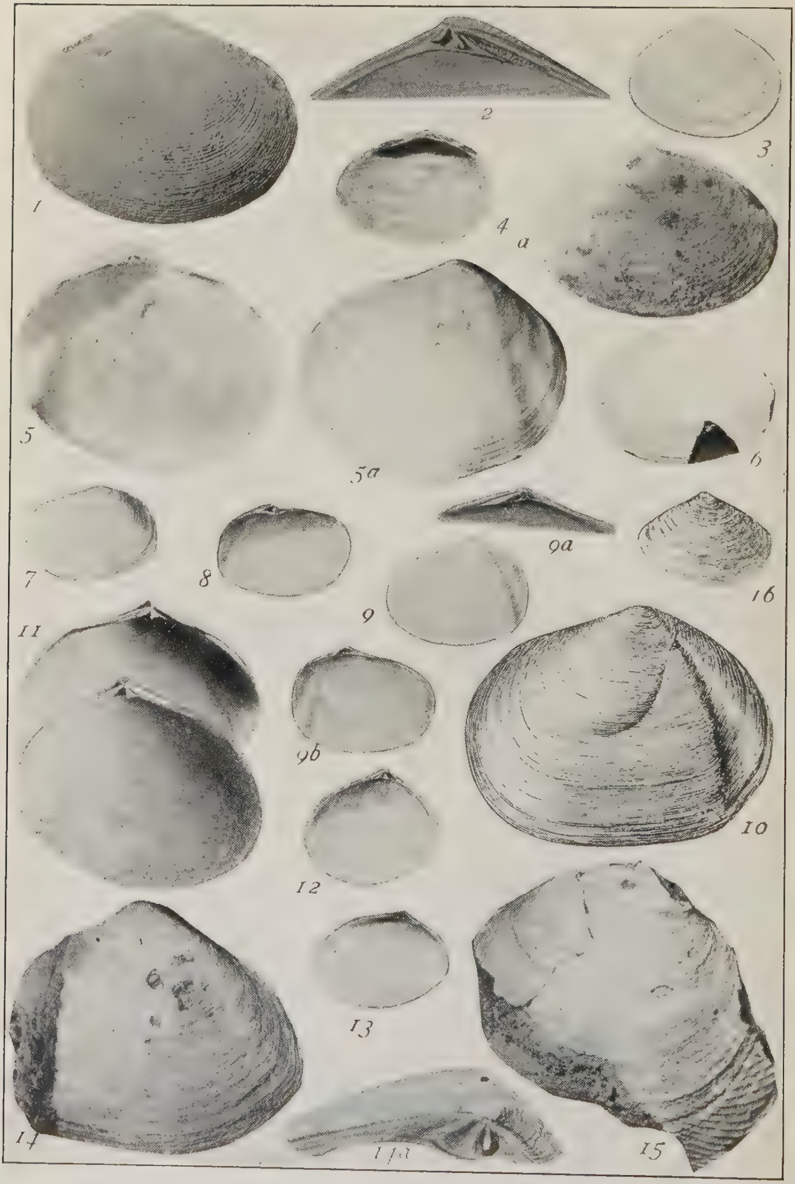
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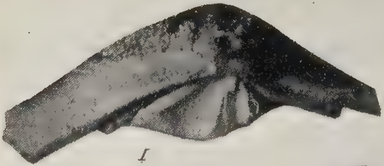
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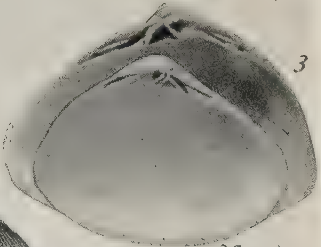
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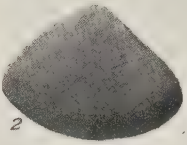
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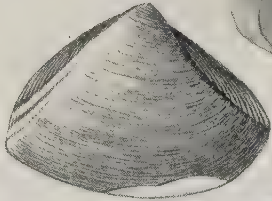
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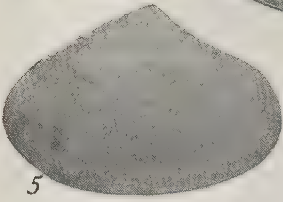
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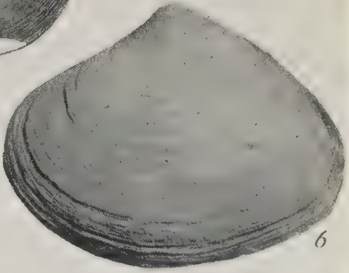
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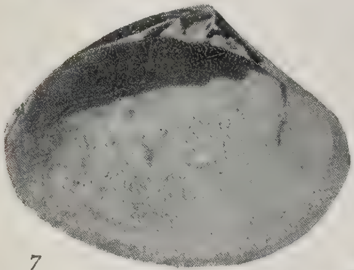
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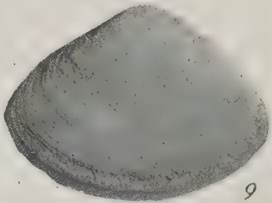
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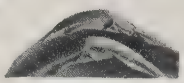
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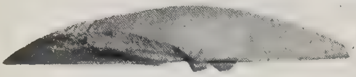
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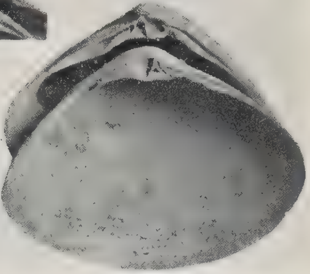
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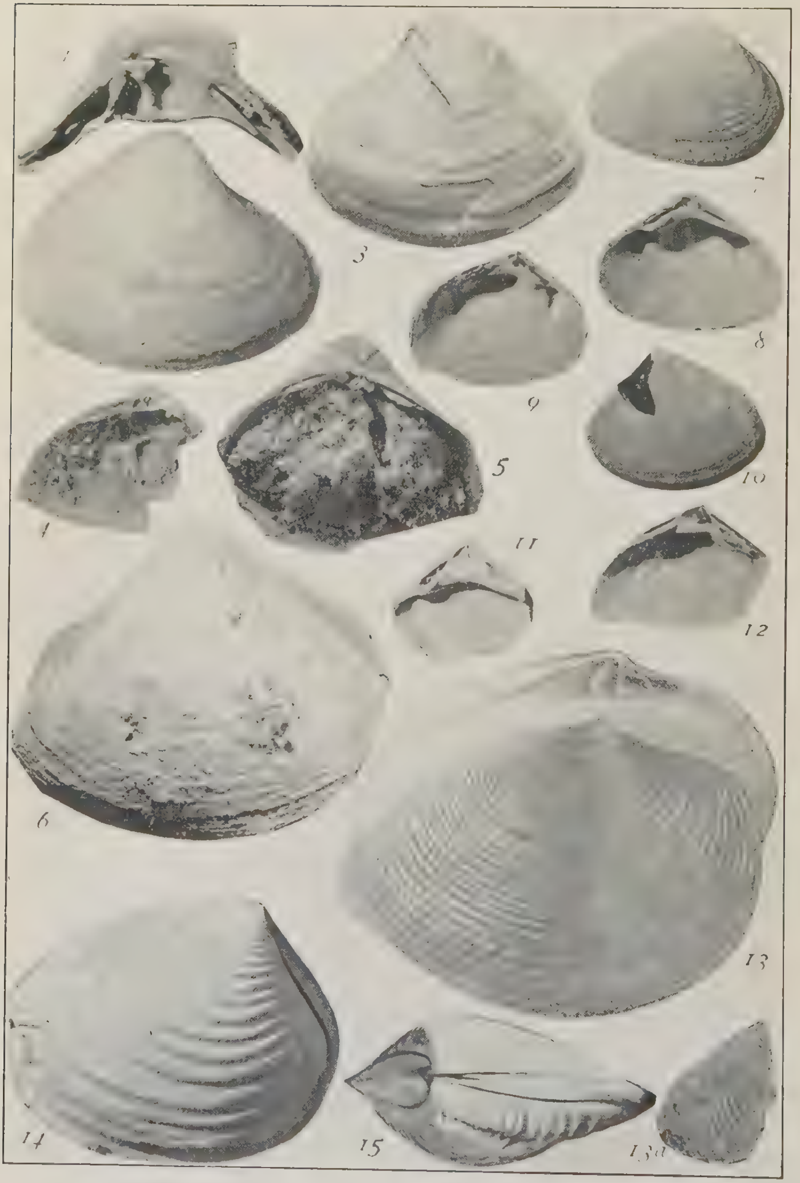
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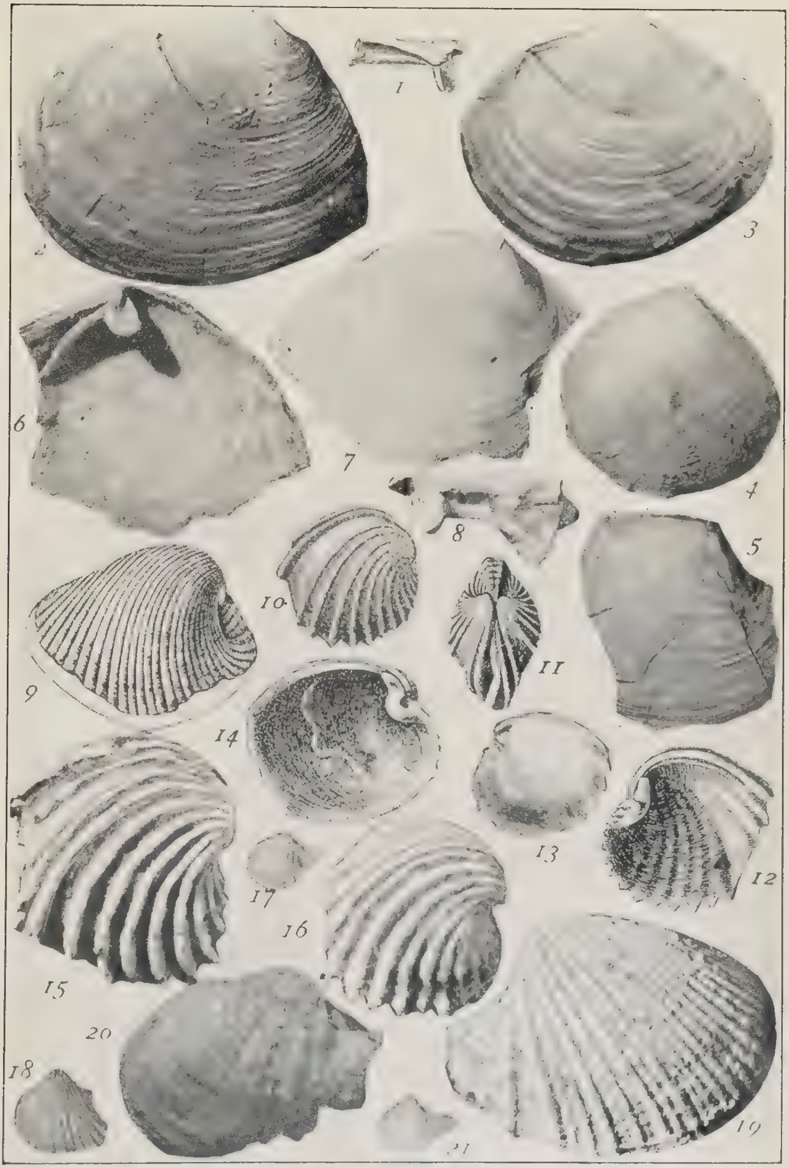
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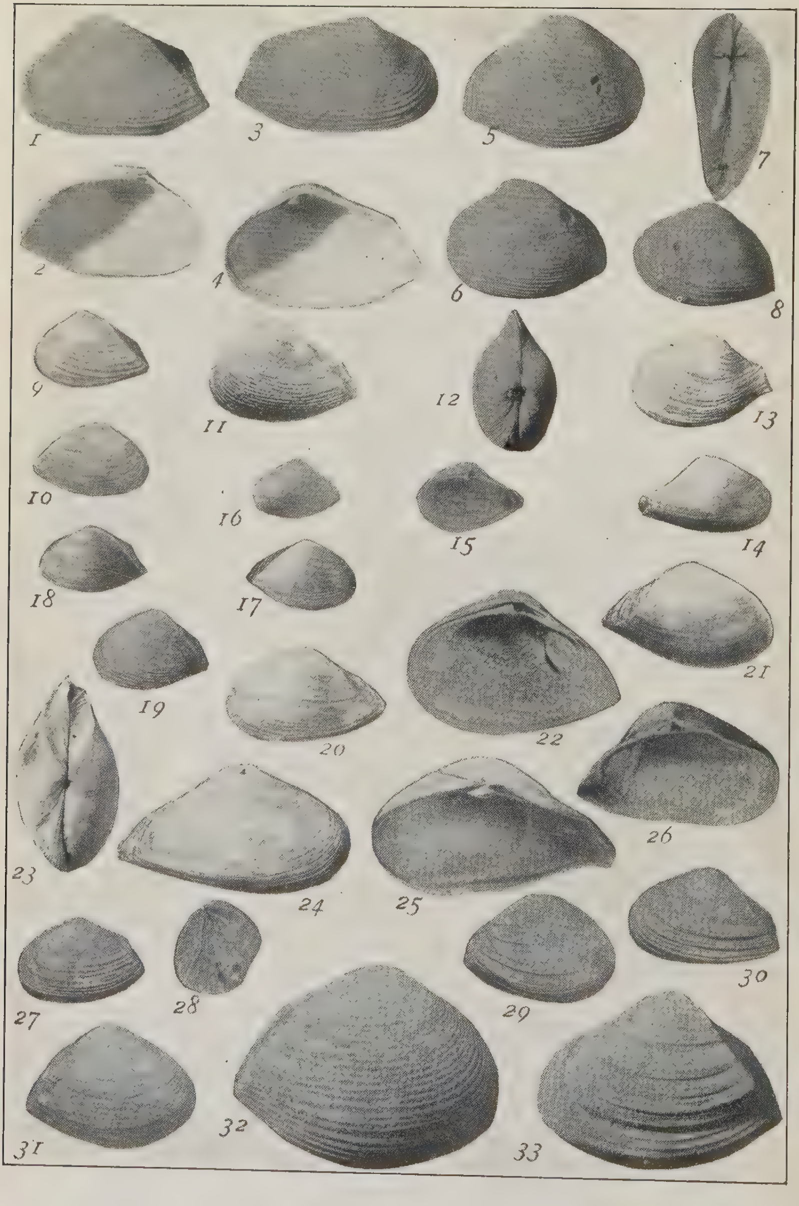
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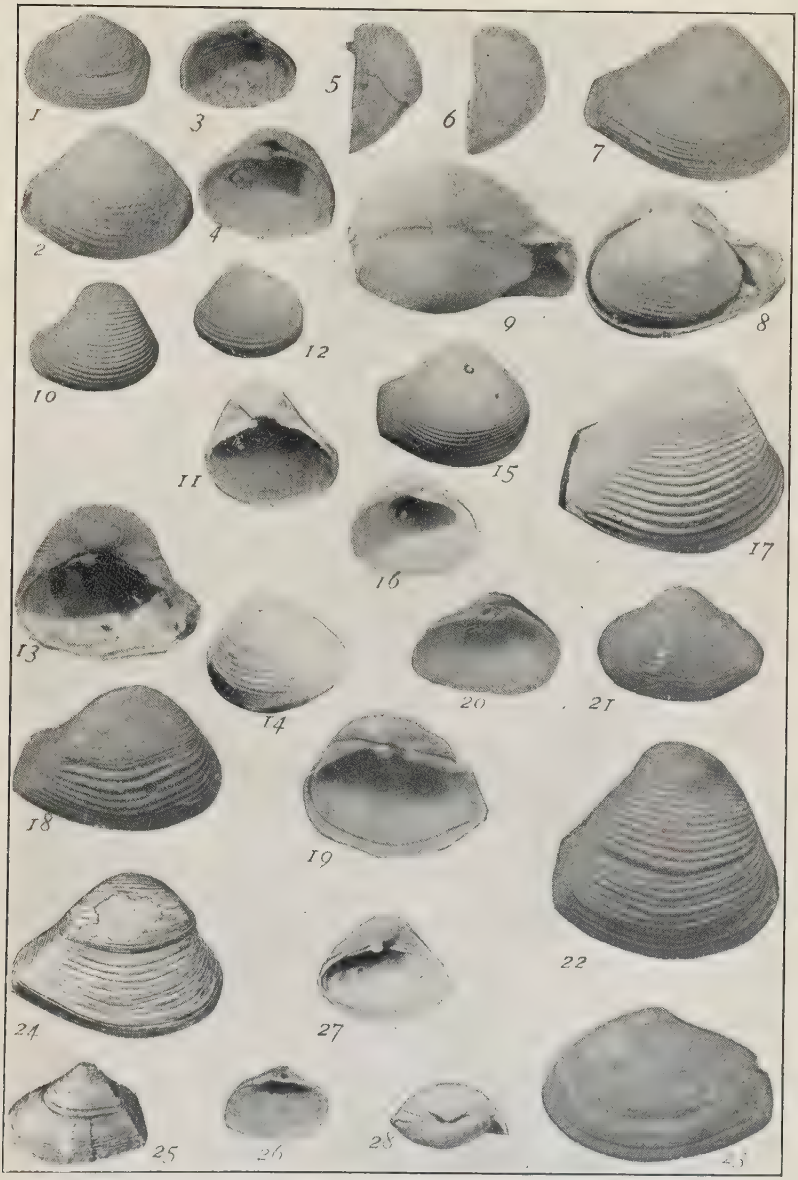
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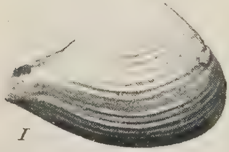
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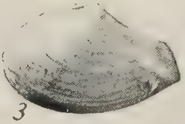
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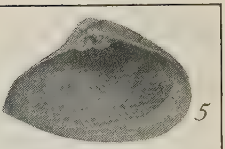
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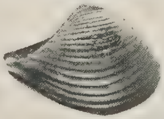
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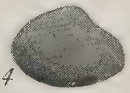
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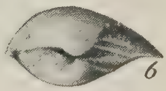
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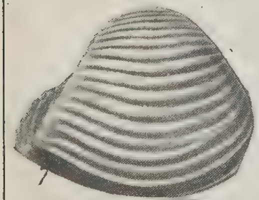
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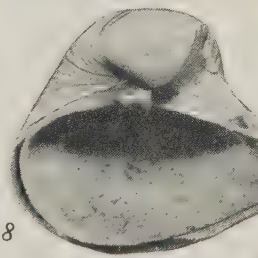
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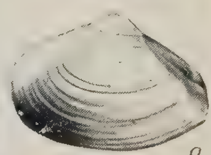
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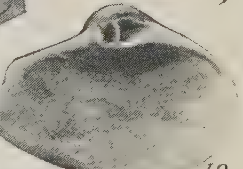
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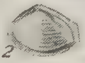
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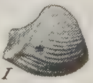
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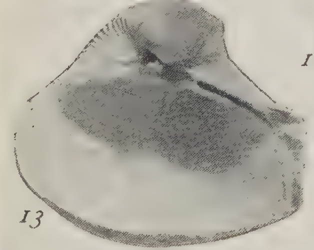
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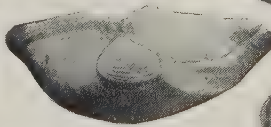
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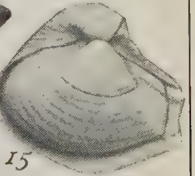
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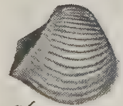
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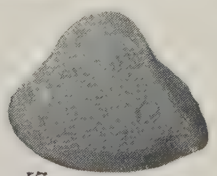
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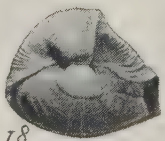
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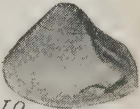
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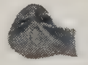
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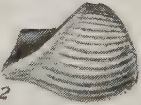
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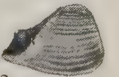
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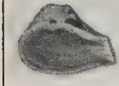
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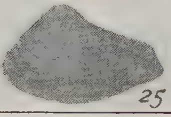
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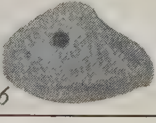
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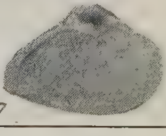
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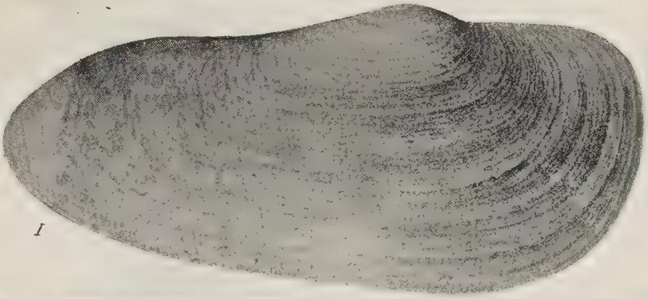
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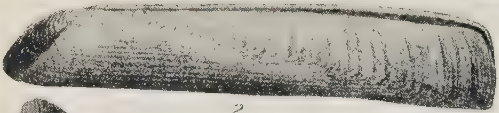
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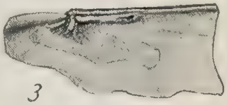
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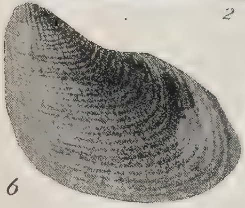
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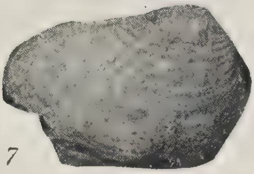
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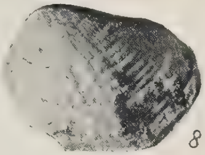
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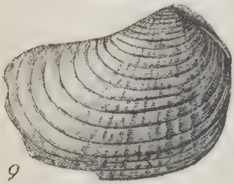
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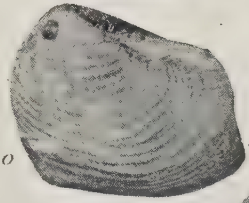
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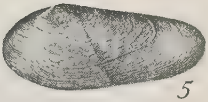
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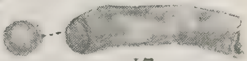
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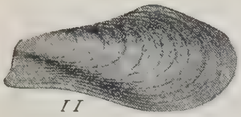
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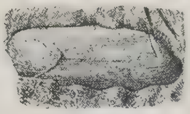
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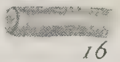
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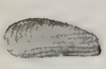
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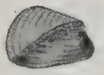
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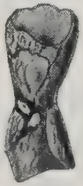
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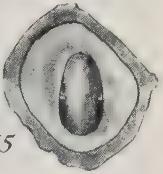
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END OF VOLUME VI

## ERRATA

Page 18, line 2, read **navicelloides** for **navicellodies**.
46, line 27, read **staminea** for **stamina**.
56, line 21, read *mucronata* for *micronata*.
64, line 33, read **Leda bella** for *Leda bella*.
67, line 17, read *quercollis* for *quircollis*.
67, line 21, read **keittensis** for **kittensis**.
70, line 18, read pl. 25 for pl. 23.
73, line 23, read Keitt's for Kitt's.
104, line 16, read fig. 6 for fig. 1.
112, line 12, read *Phacoides* for *Phaicoides*.
118, line 20, read *subvexa* for *convexa*.
124, line 33, read **anteproducta** for **anteproducaa**.
138, line 27, read pl. 44 for pl. 24.
140, line 26, read figs. 7, 8, for figs. 8, 9.
161, line 15, read *subequalis* for *subeqalis*.
185, line 27, read figs. 31-33 for figs. 31-31.
197, line 29, read 1895 for 1885.
204, line 6, read *georgiana* for *geogiana*.
214, line 9, read × 1 1-3 for × 1-3.
221, line 17, read *lisbonensis* for *lisbonenis*.
232, line 18, read *vigintinaria* for *viginitaria*.
238, lines 5, 6, read Cossmann for Cossman.
245, line 25, read × 3.7 mm. for × 37 mm.
259, line 18, read Mr. & Ald. for Dall.